PB83-168682

Evaluation of Advanced Combustion Modifications on Industrial Process Equipment (Data Supplement A). Subscale and Pilot-Scale Refinery Process Heaters

KVB, Inc.
Irvine, CA

Prepared for

Industrial Environmental Research Lab.
Research Trangle Park, NC

Feb 83

U.S. Department of Commerce
National Technical Information Service
NTIS

PB83-166682

EPA-600/7-83-011a
February 1983

EVALUATION OF ADVANCED COMBUSTION MODIFICATIONS ON INDUSTRIAL PROCESS EQUIPMENT
(DATA SUPPLEMENT A)

Subscale and Pilot-Scale Refinery Process Heaters

by

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Contract No. 68-02-2645

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Prepared for:

U. S. Environmental Protection Agency
Office of Research and Development
Washington, D. C. 20460

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

Title pg

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

1. REPORT NO.
EPA-600/7-83-011a

2.

Reproduced from best available copy.

3. RECIPIENT'S ACCESSION NO.
PB83 168682

4. TITLE AND SUBTITLE
Evaluation of Advanced Combustion Modifications on Industrial Process Equipment (Data Supplement A)

5. REPORT DATE
February 1983

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)
R. J. Tidona, H. J. Buening, and R. A. Frohoff

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
KVB, Inc.
18006 Skypark Boulevard
Irvine, California 92714

10. PROGRAM ELEMENT NO.

11. CONTRACT/GRANT NO.
68-02-2645

12. SPONSORING AGENCY NAME AND ADDRESS
EPA, Office of Research and Development
Industrial Environmental Research Laboratory
Research Triangle Park, NC 27711

13. TYPE OF REPORT AND PERIOD COVERED
Supplement; 1/78-4/81

14. SPONSORING AGENCY CODE
EPA/600/13

15. SUPPLEMENTARY NOTES IERL-RTP project officer is Robert E. Hall, Mail Drop 65, 919/541-2477.

16. ABSTRACT
The Data Supplement, presented in two volumes, documents data in greater detail than was practical in the final reports for this contract. It provides details to researchers interested in performing their own analyses. Readers are referred to the contract final reports for information on objectives, selection of units, measurement procedures, interpretations, and conclusions. (The reports are: (1) Application of Advanced Combustion Modifications to Industrial Process Equipment: Subscale Test Results, EPA-600/7-82-021 (NTIS PB82-239310), April 1982; and (2) Refinery Process Heater NOx Control Using Staged Combustion Air Lances (in preparation), EPA/IERL-RTP-1403.) Data for gaseous emission concentrations of NO, NOx, CO, HC, SO2, and SO3 are in parts per million by volume (ppm) on a dry basis corrected to 3 percent O2 by volume (dry) in the flue gas. Data in this volume are arranged by Location No. for Locations 1 and 7. A location is defined as one company or plant in which one or more units were tested. Each unit tested at a location is identified by a Unit No. The contract final reports refer to test numbers when data are discussed. Test numbers are of the form xx/yy-zz, where xx = Location No., yy = Test Series No. (e.g., oxygen variations, load variations, register adjustments), and zz = Test No. in that series.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group	
Pollution	Cements	Pollution Control	13B	11B
Combustion Control	Steel Converters	Stationary Sources	21B	11F
Industrial Processes	Nitrogen Oxides	Combustion Modification	13H	07B
Heating Equipment	Lances	Cement Kilns	13A	13I
Petroleum Industry	Flue Gases	Flue Gas Recirculation	05C	
Kilns				

18. DISTRIBUTION STATEMENT
Release to Public

19. SECURITY CLASS (This Report)
Unclassified

20. SECURITY CLASS (This page)
Unclassified

21. NO. OF PAGES
389

22. PRICE

NOTICE

This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

Limitations on Application of Data Reported

The data cited in this report are test results for measured pollutant emissions from a wide variety of industrial combustion equipment types. Only a limited number of each equipment type could be tested. Therefore, these emission levels are not suitable for use in estimating mean emissions from industrial combustion equipment classes and should not be used alone in compiling area-wide emission inventories. Also, used alone they are not suitable for predicting emissions from any one process or for setting regulatory limits or emission standards. Use of these emissions as emission standards may place a large proportion of the industrial combustion device population in noncompliance. The data can, however, be of use in supplementing other data used for these purposes. The purpose of this test program was to investigate the feasibility of combustion modifications for emissions control, not to develop a comprehensive emissions data base.

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FOREWORD

The purpose of this Data Supplement, which is presented in two volumes, is to document data in greater detail than was practical in the final report for this contract. It is intended to provide the necessary details to other researchers who are interested in performing their own analysis.

Readers are referred to the contract final reports for information as to objectives, selection of units, measurement procedures, interpretations, and conclusions*†.

All data presented for gaseous emission concentrations of NO, NO_x, CO, HC, SO_2, and SO_3 are expressed in parts per million by volume (ppm) on a dry basis corrected to 3 percent O_2 by volume (dry) in the flue gas.

The data are arranged in this volume by Location Number for Locations 1 and 7. A location is defined as one company or plant in which one or more units were tested. Each unit tested at a location is identified by a unit number. The contract final reports refer to the test number when data are discussed. The test number is of the form xx/yy-zz, where xx = location number, yy = test series number (e.g. oxygen variations, load variations, register adjustments, etc.), and zz = test number in that series.

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*Hunter, S. C., et al., "Application of Advanced Combustion Modifications to Industrial Process Equipment: Subscale Test Results," final report for EPA Contract No. 68-02-2645, submitted September 1981.

†Tidona, R. J., et al., "Refinery Process Heater NO_x Control Using Staged Combustion Air Lances," final report for EPA Contract No. 68-02-2645, submitted November 1981.

For each unit tested, the data supplement contains the following information:

1. Equipment Design Data

   Design data tabulations include: unit description, installation date, process capacity, burner description, fuels burned, combustion air temperature and other data pertinent to each unit.

2. Mobile Laboratory Data (Emission Measurements)

   Emission measurements tabulated for each test include test number, test load, combustion conditions (O_2, CO_2), gaseous emissions (NO_x, NO, CO, HC, and SO_2 all at 3 percent O_2, dry), total particulates and solid (filterable) particulates, thermal efficiency, Bacharach smoke spot number, and plume opacity.

3. Operating Data

   Data pertinent to the process are tabulated for each test.

4. Fuel Analyses

   Analyses of test fuels are included as reported for fuel samples collected during tests.

5. Particulates Measurement Data

   Particulates data include measurements of total and solid particulates by EPA Method 5.

6. Cascade Impactor Data

   Impactor data include impactor flow conditions, stage collection weights, and calculated aerodynamic particle size for each stage.

The impactor used was an Anderson 2000 Mark III with the following stage dimensions:

Stage No.	Jet Diameter, cm
1	0.1638
2	0.1253
3	0.0948
4	0.0759
5	0.0567
6	0.0359
7	0.0261
8	0.0251

7. Opacity Data

Plume opacity was observed by EPA Method 9.

8. Stack Traverse Data

Stack traverses are made with a pitot tube.

Dash marks entered on the data forms indicate that data were not available.

INSTRUMENTATION

The subscale process heater emission measurements (locational) were made with instruments carried in a 9.8 m x 2.4 m mobile laboratory which was described in detail in EPA 600/7-79-015a. All emission measurement instrumentation was transferred to a 12.8 m x 2.4 m (8 x 42 ft) mobile laboratory trailer for the tests at Location 7. The gaseous species measurements were made with analyzers located in the trailer. The particulate concentration, particulate size, and sulfur oxides measurements were made by instrumentation prepared in the wet chemistry area of the laboratory and taken to the sample port. Weighing and titrations were done at KVB's stationary laboratory facility.

The emission measurement instrumentation used was the following:

EMISSION MEASUREMENT INSTRUMENTATION

Species	Manufacturer	Measurement Method	Model No.
Hydrocarbon	Beckman Instruments	Flame Ionization	402
Carbon Monoxide	Beckman Instruments	IR Spectrometer	865
Oxygen	Teledyne	Polarographic	326A
Carbon Dioxide	Beckman Instruments	IR Spectrometer	864
Nitrogen Oxides	Thermo Electron Co.	Chemiluminescent	10A
Particulates	Andersen Samplers, Inc.	EPA Method 5 Train	EPA
Sulfur Dioxide	DuPont Instruments	UV Spectrometer	400
Particle Sizing	Andersen Samplers, Inc.	Cascade Impactor	Mark III
Smoke Spot	Bacharach	ASTM 2156-65	RCC
Opacity		EPA Method 9	
Sulfur Oxides (SO_x)		Goksoyr-Ross	

CONVERSION FACTORS

SI units to Metric or English units

To Obtain	From	Multiply By	To obtain ppm at 3% O_2 of	Multiply* Concentration in ng/J by
g/Mcal	ng/J	0.004186	**Natural Gas Fuel**	
10^6 Btu	GJ	0.984	CO	3.23
Btu	gm cal	3.9685×10^{-3}	HC	5.65
lb/10^6 Btu	ng/J	0.00233	NO or NO_x	1.96
ft	m	3.281	SO_2 or SO_x	1.41
in.	cm	0.3937		
ft^2	m^2	10.764		
ft^3	m^3	35.314	**Oil Fuel**	
lb	kg	2.205	CO	2.93
Fahrenheit	Celsius	$t_F = 9/5(t_C) + 32$	HC	5.13
Fahrenheit	Kelvin	$t_F = 1.8t_K - 460$	NO or NO_x	1.78
psig	Pa	$P_{psig} = (P_{pa})(1.450 \times 10^{-4}) - 14.7$	SO_2 or SO_x	1.28
psia	Pa	$P_{psia} = (P_{pa})(1.450 \times 10^{-4})$		
iwg (39.2°F)	Pa	$P_{iwg} = (P_{pa})(4.014 \times 10^{-3})$	**Coal Fuel**	
10^6 Btu/hr	MW	3.413	CO	2.69
GJ/hr	MW	3.60	HC	4.69
			NO or NO_x	1.64
			SO_2 or SO_x	1.18

*These conversions depend on fuel composition.
The values given are for typical fuels.

CONVERSION FACTORS

English or Metric units to SI units

To Obtain	From	Multiply By	To obtain ng/J of	Multiply* Concentration in ppm @ 3% O_2 by
ng/J	lb/10^6 Btu	430	Natural Gas Fuel	
ng/J	g/Mcal	239	CO	0.310
GJ	10^6 Btu	1.055	HC	0.177
m	ft	0.3048	NO or NO_x (as NO_2)	0.510
cm	in.	2.54	SO_2 or SO_x	0.709
m^2	ft^2	0.0929		
m^3	ft^3	0.02832		
kg	lb	0.4536	Oil Fuel	
Celsius	Fahrenheit	$t_C = 5/9\ (t_F - 32)$	CO	0.341
Kelvin	Fahrenheit	$t_K = 5/9\ (t_F - 32) + 273$	HC	0.195
Pa	psig	$P_{pa} = (P_{psig} + 14.7)(6.895 \times 10^3)$	NO or NO_x (as NO_2)	0.561
Pa	psia	$P_{pa} = (P_{psia})(6.895 \times 10^3)$	SO_2 or SO_x	0.780
Pa	iwg (39.2°F)	$P_{pa} = (P_{iwg})(249.1)$	Coal Fuel	
MW	10^6 Btu/hr	0.293	CO	0.372
MW	GJ/hr	0.278	HC	0.213
			NO or NO_x (as NO_2)	0.611
			SO_2 or SO_x	0.850

*These conversions depend on fuel composition.

The values given are for typical fuels.

LOCATION 1 - SUBSCALE PROCESS HEATER

TEST FURNACE

Location No. 1 **Unit No.** 4

Unit Description TEST FURNACE
- SINGLE-BURNER FIRING VERTICALLY UPWARD
- RECTANGULAR FIREBOX, REFRACTORY-LINED, 2.4m × 1.8m × 9.8m high
- NATURAL DRAFT

Installation Date

Heater Rating 2.9 MW (10×10^6 Btu/h)

Burner Description ZINK MA-16 and ZINK DBA-16 (CONVENTIONAL)
ZINK TERTIARY AIR BURNER AND RECIRCULATING TILE BRN. (LO-NO_x)

Test Fuel Combinations NATURAL GAS, No.6 OIL, No.2 Oil, and
Shale Oil

Fuel Temp. at Burner (°F) NG = AMBIENT = No.2 OIL, 245°F = No.6 Oil, 150°F = SHALE OIL

Primary Air Temp. (°F) AMBIENT

Comments:

MOBILE LABORATORY DATA

Test No.________

Test No.________ Date JAN 12 1978 Location 1 Engr. K.

Unit No. 4 Fuel N. G. Capacity________

Unit Type Test Heater Burner Type MA-16 / Poll-2

1. Test No.	1/1-1		—		—		—		→	
2. Date	1-12-78		—		—		—		→	
3. Time	15:15		15:45		16:15		16:45		17:15	
4. Load MBTU	5.1		5.1		5.1		5.1		5.1	
5. Process Rate										
6. Flue Diam. or Size, ft	8'x 6'		—		—		—		→	
7. Probe Position	Center		—		—		—		→	
8. Oxygen (%)	2.8		2.75		2.6		2.8		2.8	
9. NOx (hot) read/3% O_2 (ppm)	92	91	88	87	93	91	90	89	93	92
10. NO (hot) read/3% O_2 (ppm)	86	85	84	83	86	84	84	83	88	87
11. NO_2 (hot) read/3% O_2 (ppm)	6	6	4	4	7	7	6	7	5	5
12. NO (cold) read/3% O_2 (ppm)	113	112	103	102	108	106	109	108	108	107
13. Carbon Dioxide (%)	11.0		11.0		11.2		10.9		10.9	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	5	5	5	5	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	–		–		–		–		–	
18. Atmos. Temp. (°F/°C)	37		37		36		35		34	
19. Dew Point Temp. (°F/°C)	–		–		–		–		–	
20. Atmos. Pressure (in. Hg)	29.54		29.54		29.54		29.54		29.54	
21. Relative Humidity (%)	–		–		–		–		–	
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.	Baseline		—		—		—		→	

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.**________

Test No.________ **Date** JAN 13 1978 **Location** 1 **Engr.**________

Unit No. 4 **Fuel** N.G **Capacity** 6.5 X 10^6 BTU/H FIRING RATE

Unit Type RESEARCH FURNACE **Burner Type** MA-16, Pattern II

1. Test No.	1/1-2		1/1-3		1/1-4		1/1-5		1/1-6	
2. Date	1-13-78		→							
3. Time	1015		1045		1145		1310		1345	
4. Load (10^6 BTUH)	5.1		→							
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	3.9		2.9		2.1		1.1		0.25	
9. NOx (hot) read/3% O_2 (ppm)	88	93	92	91	95	90	84	76	80	69
10. NO (hot) read/3% O_2 (ppm)	83	87	88	88	93	89	81	73	78	68
11. NO_2 (hot) read/3% O_2 (ppm)	5	6	4	3	2	1	3	3	2	2
12. NO (cold) read/3% O_2 (ppm)	99	104	105	104	109	104	98	89	94	82
13. Carbon Dioxide (%)	10.2		10.9		10.9		12.8		12.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	160	139
15. Hydrocarbon (ppm) uncor/cor	IOOS		→							
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	30		38		41		43		44	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.58		29.62		29.62		29.61		29.61	
21. Relative Humidity (%)										
22.										
23.	Baseline		Baseline		O_2 Swing		O_2 Swing		O_2 Swing	
24.					Low O_2		Low O_2		Low O_2	
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.**________

Test No.________ **Date** 1-13-78 **Location** 1 **Engr.**________

Unit No. 4 **Fuel** NG **Capacity** 6.5×10^6 BTU/H

Unit Type RESEARCH FURNACE **Burner Type** MA-16, PATT. II

1. Test No.	1/1-7		1/1-8							
2. Date	1-13-78		1-13-78							
3. Time	1515		1535							
4. Load 10^6 BTU/H	5.1		5.1							
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		8'x6'							
7. Probe Position	Center		Center							
8. Oxygen (%)	3.7		3.0							
9. NOx (hot) read/3% O_2 (ppm)	98	102	98	98						
10. NO (hot) read/3% O_2 (ppm)	95	99	96	96						
11. NO_2 (hot) read/3% O_2 (ppm)	3	3	2	2						
12. NO (cold) read/3% O_2 (ppm)	111	115	111	111						
13. Carbon Dioxide (%)	11.0		11.0							
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0						
15. Hydrocarbon (ppm) uncor/cor	IC	OS	→							
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0						
17. Smoke Spot (Bacharach)	–		–							
18. Atmos. Temp. (°F/°C)	40		40							
19. Dew Point Temp. (°F/°C)	–		–							
20. Atmos. Pressure (in. Hg)	29.64		29.64							
21. Relative Humidity (%)	-		-							
22.										
23.										
24.	O_2 Swing		O_2 Swing							
25.	High O_2		Baseline							
26.			Check							
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No.________ Date 1-16-78 Location 1 Engr.________

Unit No. 4 Fuel N.G. Capacity 6.5 x 10⁶ BTU/HR

Unit Type________ Burner Type MA-16 PATTERN IV

1. Test No.	1/1-9								→	
2. Date	1-16-78								→	
3. Time	10:00		1040		1105		1145		12:20	
4. Load x 10⁶ BTU/HR	5.1								→	
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'								→	
7. Probe Position	Center								→	
8. Oxygen (%)	3.4		3.35		3.3-3.6		3.5-39		3.8	
9. NOx (hot) read/3% O_2 (ppm)	94	96	95	97	95	97	98	102	96	100
10. NO (hot) read/3% O_2 (ppm)	93	95	93	95	95	97	95	99	90	94
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	2	2	0	0	3	3	6	6
12. NO (cold) read/3% O_2 (ppm)	111	114	114	116	114	117	110	114	110	115
13. Carbon Dioxide (%)	10.2		10.6		10.6		9.9		10.2	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	IOOS									→
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		.		-		—		—	
18. Atmos. Temp. (°F/°C)	32		31		30		28		27	
19. Dew Point Temp. (°F/°C)	-		-		-		-		-	
20. Atmos. Pressure (in. Hg)	29.45		29.45		29.48		29.47		29.46	
21. Relative Humidity (%)										
22.										
23.										
24.	Baseline								→	
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 1/1-10 Date 1-16-78 Location 1 Engr.

Unit No. 4 Fuel N.G. Capacity 6.5x10^6 Btu/h

Unit Type RESEARCH FURNACE Burner Type MA-16 Patt II (modified)

1. Test No.	1/1-10		→							
2. Date	1-16-78		→							
3. Time	13:35		14:10		14:35		15:00		15:35	
4. Load BTU x 10^6	5.1		→							
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		→							
7. Probe Position	center		→							
8. Oxygen (%)	3.2		3.05		3.0		3.0		3.0-3.2	
9. NOx (hot) read/3% O_2 (ppm)	103	104	102	102	100	100	102	102	98	99
10. NO (hot) read/3% O_2 (ppm)	98	99	100	100	98	98	101	101	95	96
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	2	2	2	2	1	1	3	3
12. NO (cold) read/3% O_2 (ppm)	115	116	115	115	119	119	118	118	117	118
13. Carbon Dioxide (%)	10.2		10.6		11.0		11.0		11.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	27		27		27		27		23	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.46		29.48		29.50		29.53		29.54	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	Baseline		Baseline		Baseline		Baseline		Baseline	
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No. 1/1 - 11 Date 1-17-78 Location 1 Engr.________

Unit No. 4 Fuel #6 Capacity________

Unit Type________ Burner Type HA-16 Tip 764

1. Test No.	1/1-11		→							
2. Date	1-17-78		→							
3. Time	13:05		13:35		14:10		14:45		15:45	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	3.2		3.0-3.2		3.0-3.2		3.2-3.9		3.2-3.3	
9. NOx (hot) read/3% O_2 (ppm)	275	278	278	280	278	280	276	285	279	283
10. NO (hot) read/3% O_2 (ppm)	270	273	270	272	269	271	270	279	270	274
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	8	8	9	9	6	6	9	9
12. NO (cold) read/3% O_2 (ppm)	305	308	320	322	315	317	303	313	305	307
13. Carbon Dioxide (%)	13.0		13.0		13.3		13.3		13.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	1094	1106	1160	1166	1170	1177	1140	1176	1280	1298
17. Smoke Spot (Bacharach)	3		3		3		3		3	
18. Atmos. Temp. (°F/°C)	17		16		20		19		19	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.74		29.74		29.73		29.70		29.72	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	Baseline		→							
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.**________

Test No.________ **Date** 1-18-78 **Location** 1 **Engr.**________

Unit No. 4 **Fuel** #6 **Capacity**________

Unit Type________ **Burner Type** MA-16 Tip 764

Excess O_2 Variation

1. Test No.	1/1-12		1/1-12		1/1-13		1/1-14		1/1-15	
2. Date	1-18-78		→							
3. Time	9:40		9:05		10:40		11:10		11:40	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	2.7-3.4		2.8-3.1		1.9-2.1		1.1		.5-1.0	
9. NOx (hot) read/3% O_2 (ppm)	270	271	285	284	287	272	290	262	250	222
10. NO (hot) read/3% O_2 (ppm)	265	266	280	279	277	262	275	249	250	222
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	5	5	10	10	15	13	0	0
12. NO (cold) read/3% O_2 (ppm)	300	301	310	309	318	301	312	282	320	284
13. Carbon Dioxide (%)	14.0		13.6		14.2		14.4		15.2	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	800 5.6	706
15. Hydrocarbon (ppm) uncor/cor	-	-	-	-	-	-	-	-	-	-
16. Sulfur Dioxide (ppm) uncor/cor	1170	1173	1170	1167	1348	1277	1320	1194	1680	1404
17. Smoke Spot (Bacharach)	3		3		4		5		7	
18. Atmos. Temp. (°F/°C)	20		22		21		20		21	
19. Dew Point Temp. (°F/°C)	-		-		-		-		-	
20. Atmos. Pressure (in. Hg)	29.77		29.77		29.80		29.8		29.8	
21. Relative Humidity (%)	-		-		-		-		-	
22.										
23.	Baseline		Baseline		O_2 swing		O_2 swing		O_2 swing	
24.					low O_2		low O_2		Min O_2	
25.									Light Haze	
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No.________ Date 1·18·78 Location 1 Engr.________

Unit No. 4 Fuel #6 Capacity________

Unit Type________ Burner Type MA·16 Tip 764

1. Test No.	1/1-16		1/1-17							
2. Date	1-18-78		1-18-78							
3. Time	12:20		12:45							
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		8'x6'							
7. Probe Position	center		center							
8. Oxygen (%)	3.5 - 4.2		.7							
9. NOx (hot) read/3% O_2 (ppm)	276	290	282	250						
10. NO (hot) read/3% O_2 (ppm)	275	289	272	241						
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	10	9						
12. NO (cold) read/3% O_2 (ppm)	291	305	305	270						
13. Carbon Dioxide (%)	13.5		15.2							
14. Carbon Monoxide (ppm) uncor/cor	0	0	20-300	17-266						
15. Hydrocarbon (ppm) uncor/cor	-	-	-	-						
16. Sulfur Dioxide (ppm) uncor/cor	1160	1217	1680	1490						
17. Smoke Spot (Bacharach)	2.5		6							
18. Atmos. Temp. (°F/°C)	23		24							
19. Dew Point Temp. (°F/°C)	-		-							
20. Atmos. Pressure (in. Hg)	29.8		29.8							
21. Relative Humidity (%)	-		-							
22.										
23.	O_2 saving		O_2 saving							
24.	Hi O_2		Min O_2							
25.			Smoke							
26.			Limit							
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA.

Test No. ________

Test No. 1/1-16 Date 1-18-78 Location 1 Engr. ________

Unit No. 4 Fuel #6 Capacity ________

Unit Type ________ Burner Type MA-16 Tip 763

1. Test No.	1/1-18		—		—		—		→	
2. Date	1-18-78		—		—		—		→	
3. Time	13:50		14:20		15:00		15:30		15:55	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		8'x6'		—		—		→	
7. Probe Position	center		center		—		—		→	
8. Oxygen (%)	2.9-3.1		2.9		2.8		2.7-2.9		3.2-3.4	
9. NOx (hot) read/3% O_2 (ppm)	255	255	253	252	254	251	253	250	257	261
10. NO (hot) read/3% O_2 (ppm)	250	350	249	248	250	247	250	247	250	254
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	4	4	4	4	3	3	7	7
12. NO (cold) read/3% O_2 (ppm)	279	279	279	277	281	278	282	279	281	286
13. Carbon Dioxide (%)	13.8		14.0		13.8		13.8		13.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	1230	1230	1350	1343	1300	1286	1260	1246	1240	1260
17. Smoke Spot (Bacharach)	2		2		1		1.5		2	
18. Atmos. Temp. (°F/°C)	24		23		24		24		24	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.78		29.79		29.79		29.79		29.79	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	Baseline		Baseline		Baseline		Baseline		Baseline	
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 1/1-

Date JAN 18 1978

Location

Engr.

Unit No. 4

Fuel #6

Capacity 6,5 x 10⁶ Btu/h

Unit Type RESEARCH FURNACE

Burner Type MR-16 Tip 765

1. Test No.	1/1-19		→							
2. Date	1-19-78		→							
3. Time	9:05		9:35		10:25					
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	2.8 - 3.0		2.8 - 3.2							
9. NOx (hot) read/3% O_2 (ppm)	245	244	255	255						
10. NO (hot) read/3% O_2 (ppm)	238	237	245	245						
11. NO_2 (hot) read/3% O_2 (ppm)	7	7	10	10						
12. NO (cold) read/3% O_2 (ppm)	275	273	275	275						
13. Carbon Dioxide (%)	11.8		11.6							
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0				
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	-				
16. Sulfur Dioxide (ppm) uncor/cor	1200	1193	1020	1020						
17. Smoke Spot (Bacharach)			2							
18. Atmos. Temp. (°F/°C)	20		20							
19. Dew Point Temp. (°F/°C)	–		–		–					
20. Atmos. Pressure (in. Hg)	29.85		29.85		29.85					
21. Relative Humidity (%)	–									
22.										
23.	Baseline		Baseline		Baseline					
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No. 1/1- Date 1-19-78 Location 1 Engr.________

Unit No. 4 Fuel #6 Capacity________

Unit Type________ Burner Type MA-16 Tip 763

1. Test No.	1/1-20		1/1-21		1/1-22		1/1-23		1/1-24	
2. Date	1-19-78		→							
3. Time	11:00		11:40		12:00		12 25		12:45	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	6'x8'		→							
7. Probe Position	center		→							
8. Oxygen (%)	3.0-3.3		3.35-3.6		0.7-1.0		2.0-2.4		3.6-4.0	
9. NOx (hot) read/3% O_2 (ppm)	250	252	243	249	229	205	250	239	245	256
10. NO (hot) read/3% O_2 (ppm)	244	246	238	244	223	199	245	235	240	251
11. NO_2 (hot) read/3% O_2 (ppm)	6	6	5	5	6	6	5	4	5	5
12. NO (cold) read/3% O_2 (ppm)	275	277	269	276	249	222	280	268	270	283
13. Carbon Dioxide (%)	13.3		13.3		14.8		13.8		13.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	20	18	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	1312	1323	1220	1253	1390	1242	1240	1187	1080	1130
17. Smoke Spot (Bacharach)	2		2		4		2		2	
18. Atmos. Temp. (°F/°C)	20		18		20		17		19	
19. Dew Point Temp. (°F/°C)	—		—		—		—			
20. Atmos. Pressure (in. Hg)	29.86		29.88		29.88		29.88		29.88	
21. Relative Humidity (%)	—		—		—		—			
22.										
23.	Baseline		Baseline		O_2 swing		O_2 Swing		O_2 swing	
24.					(CO limit)		(Low O_2)		(High O_2)	
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/1-25 Date 1-20-78 Location 1 Engr.________

Unit No. 4 Fuel No. 2 Oil Capacity 6.5 x 10⁶ Btu/h

Unit Type Research Furnace Burner Type MA-16 Tip 764

1. Test No.	1/1-25									
2. Date	1-20-78									
3. Time	11:35		12:05		12:25		13:05		13:20	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8' x 6'									
7. Probe Position	Center									
8. Oxygen (%)	3.0-3.6		3.1-3.2		2.8		3.0		3.0	
9. NOx (hot) read/3% O_2 (ppm)	90	92	94	95	97	96	97	97	92	92
10. NO (hot) read/3% O_2 (ppm)	87	88	92	93	93	92	93	93	90	90
11. NO_2 (hot) read/3% O_2 (ppm)	3	4	2	2	4	4	4	4	2	2
12. NO (cold) read/3% O_2 (ppm)	98	100	111	112	113	112	108	108	106	106
13. Carbon Dioxide (%)	11.3		13.0		13.0		13.0		13.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	-	-	-	-	-	-	-	-	-	-
16. Sulfur Dioxide (ppm) uncor/cor	40	41	60	61	30	30	30	30	30	30
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	22		25		23		25		25	
19. Dew Point Temp. (°F/°C)	-		-		-		-		-	
20. Atmos. Pressure (in. Hg)	29.85		29.84		29.84		29.83		29.80	
21. Relative Humidity (%)	-		-		-		-		-	
22.										
23.	Baseline		Baseline		Baseline		Baseline			
24.										
25.	Primary air damper						All dampers			
26.			30% open				100% open			
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/2 - 1&2 Date 2/13/78 Location 1 Engr. T. [illegible]

Unit No. 4 Fuel N.G. Capacity 6.5×10^6 Btu/h

Unit Type RESEARCH FURNACE Burner Type DBA-16 Low-NO_x (Recirculating Tile)
PATTERN III GAS TIPS

1. Test No.	1/2 - 1						→		1/2 - 2	
2. Date	2-13-78								→	
3. Time	1510		1545		1620		1645		1730	
4. Load										
5. Process Rate (Btu/h)	5×10^6 [illegible]		5×10^6		5×10^6		5×10^6			
6. Flue Diam. or Size, ft	6' x 8'								→	
7. Probe Position	Center								→	
8. Oxygen (%)	2.1-2.8		2.9-3.1		2.8-3.0		2.8-3.1		2.9-3.0	
9. NOx (hot) read/3% O_2 (ppm)	103	100	101	101	108	107	108	107	120	119
10. NO (hot) read/3% O_2 (ppm)	100	97	100	100	105	104	104	103	115	114
11. NO_2 (hot) read/3% O_2 (ppm)	3	3	1	1	3	3	4	4	5	5
12. NO (cold) read/3% O_2 (ppm)	127	123	125	125	130	129	126	125	141	140
13. Carbon Dioxide (%)	10.9		10.2		10.6		10.8		11.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	100-200	97-194	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	34°F		32°F		33°F		35°F		33°F	
19. Dew Point Temp. (°F/°C)	–		–		–		–		–	
20. Atmos. Pressure (in. Hg)	29.43		29.43		29.43		29.43		29.43	
21. Relative Humidity (%)	–		–		–		–		–	
22.										
23.										
24.	Baseline		Baseline		Baseline		Baseline		Baseline	
25.									Gas tips	
26.			Gas Tips		Flush with				½" below	
27.			top of "piece		A" of				top of piece A	
28.			burner tile							
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 1/2-2 Date 2-13-78 Location Engr. Tahw

Unit No. 4 Fuel N.G. Capacity 6.5×10^6 Btu/h

Unit Type Burner Type DBA-16 Lo NO_x, PATT III Tips

1. Test No.	1/2-2					
2. Date	2-13-78					
3. Time	1800					
4. Load						
5. Process Rate (Btu/h)	5×10^6					
6. Flue Diam. or Size, ft	8'x6'					
7. Probe Position	Center					
8. Oxygen (%)	2.5-3.0					
9. NOx (hot) read/3% O_2 (ppm)	121 / 120					
10. NO (hot) read/3% O_2 (ppm)	117 / 116					
11. NO_2 (hot) read/3% O_2 (ppm)	4 / 4					
12. NO (cold) read/3% O_2 (ppm)	142 / 141					
13. Carbon Dioxide (%)	10.7					
14. Carbon Monoxide (ppm) uncor/cor	0 / 0					
15. Hydrocarbon (ppm) uncor/cor	— / —					
16. Sulfur Dioxide (ppm) uncor/cor	0 / 0					
17. Smoke Spot (Bacharach)	0					
18. Atmos. Temp. (°F/°C)	33°F					
19. Dew Point Temp. (°F/°C)	—					
20. Atmos. Pressure (in. Hg)	29.48					
21. Relative Humidity (%)	—					
22.						
23.	Baseline					
24.	Gas tips 1/2"					
25.	below top					
26.	of piece A					
27.						
28.						
29.						
30.						

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/2-3 Date 2-14-78 Location________ Engr. T

Unit No. 4 Fuel #2 oil Capacity 6.5×10⁶ Btu/h

Unit Type ROTOHREN FURNACE Burner Type DBA-16 LO-NOx, OIL TIP 766

1. Test No.	1/2-3									
2. Date	2-14-78									
3. Time	1215		1245		1315		1435		1415	
4. Load										
5. Process Rate (Btu/h)	5×10⁶									
6. Flue Diam. or Size, ft	8'×6'									
7. Probe Position	Center									
8. Oxygen (%)	2.4	2.9	4.3 - 4.5		3.8	4.2	4.1	4.6	4.0	4.0
9. NOx (hot) read/3% O_2 (ppm)	83	81	88	95	86	91	93	101	86	91
10. NO (hot) read/3% O_2 (ppm)	80	78	85	92	82	87	89	96	81	86
11. NO_2 (hot) read/3% O_2 (ppm)	3	3	3	3	4	4	4	5	5	5
12. NO (cold) read/3% O_2 (ppm)	98	96	98	106	99	105	101	109	103	109
13. Carbon Dioxide (%)	13.2		12.4		12.6		12.4		12.4	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	-
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	40	42	30	32	20	21
17. Smoke Spot (Bacharach)	2		2		2		1/2		1	
18. Atmos. Temp. (°F/°C)	37°F		37°F		39°F		38°F		40°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.7		29.7		29.7		29.7		29.7	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	Baseline									
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/2-4to7 Date 2-14-78 Location 1 Engr. Tidona

Unit No. 4 Fuel #2 oil Capacity 6.5×10⁶ Btu/h

Unit Type Reheat Furnace Burner Type DBA-16 LO-NO$_x$

1. Test No.	1/2-4		1/2-5		1/2-6		1/2-7		→	
2. Date	2-14-78		2-14-78		2-14-78		2-14-78		2-14-78	
3. Time	1430		1515		1550		1715		1735	
4. Load										
5. Process Rate (Btu/h)	5×10⁶		5×10⁶		5×10⁶		3.3×10⁶		3.3×10⁶	
6. Flue Diam. or Size, ft	8'×6'		8'×6'		→					
7. Probe Position	Center		Center		→					
8. Oxygen (%)	1.4-1.4		.25-.70		5.15-5.0		5.5-5.5		5.9-6.9	
9. NOx (hot) read/3% O_2 (ppm)	89	82	94	82	105	119	80	93	85	101
10. NO (hot) read/3% O_2 (ppm)	88	81	90	79	96	109	78	91	83	99
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	4	3	9	10	2	2	2	2
12. NO (cold) read/3% O_2 (ppm)	105	96	110	96	96	109	69	80	71	85
13. Carbon Dioxide (%)	14.4		14.4		12		12		11.8	
14. Carbon Monoxide (ppm) uncor/cor	0	0	50-285	44-250	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	—	—	70	81	120	143
17. Smoke Spot (Bacharach)	1		2		0		4		4	
18. Atmos. Temp. (°F/°C)	42°F		42°F		43°F		42°F		39°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.7		29.68		29.68		29.68		29.68	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	O_2 SWING		O_2 Swing		O_2 Swing		50% CAPACITY		50% CAPACITY	
24.	(optimum low)		(co limit)		(high O_2)					
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/2-8 Date 2-15-78 Location 1 Engr. [illegible]

Unit No. 4 Fuel N.G. Capacity 6.5×10^6 Btu/h

Unit Type RESEARCH FURNACE Burner Type DBA-11c LE-NOx, Part I

1. Test No.	1/2-8									→
2. Date	2-15-78									→
3. Time	0940		1000		1105		1130		1155	
4. Load										
5. Process Rate	5×10^6									→
6. Flue Diam. or Size, ft	8'×6'									→
7. Probe Position	Center									→
8. Oxygen (%)	3.4-3.5		3.35-3.35		2.9-2.9		2.7-3.1		2.55-2.95	
9. NOx (hot) read/3% O_2 (ppm)	88	90	89	91	89	89	88	88	89	89
10. NO (hot) read/3% O_2 (ppm)	88	90	89	91	85	85	88	88	88	88
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	0	0	4	4	0	0	1	1
12. NO (cold) read/3% O_2 (ppm)	101	104	105	107	105	104	104	104	104	103
13. Carbon Dioxide (%)	9.6		8.8		10.2		10.4		10.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0			
18. Atmos. Temp. (°F/°C)	29°F		33°F		30°F		33°F		34°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	→
20. Atmos. Pressure (in. Hg)	29.68		29.68		29.70		29.70		29.70	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	BASELINE		Baseline		Baseline		Baseline		Baseline	
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/2-9to13 Date 2-15-78 Location 1 Engr. Tidona

Unit No. 4 Fuel N.G. Capacity 6.5 x 10^6 Btu/h

Unit Type Research Furnace Burner Type DRA-16 Lo-NOx, Part I

1. Test No.	1/2-9.		1/2-10		1/2-11		1/2-12		1/2-13	
2. Date	2-15-78								→	
3. Time	1355		1450		1510		1550		1650	
4. Load										
5. Process Rate	5 x 10^6						→		6.5 x 10^6	
6. Flue Diam. or Size, ft	8'x6'								→	
7. Probe Position	Center								→	
8. Oxygen (%)	1.57-1.60		.55-.60		4.3-4.4		2.7-2.8		2.9 3.05	
9. NOx (hot) read/3% O_2 (ppm)	86	79	76	70	90	97	88	87	93	93
10. NO (hot) read/3% O_2 (ppm)	76	70	74	65	90	97	81	80	91	91
11. NO_2 (hot) read/3% O_2 (ppm)	10	9	2	5	0	0	7	7	2	2
12. NO (cold) read/3% O_2 (ppm)	96	88	88	78	101	109	107	106	113	113
13. Carbon Dioxide (%)	10.6		12		9.95		10.6		10.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	50	44	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	38°F		39°F		39°F		39°F		40°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.70		29.68		29.68		29.68		29.68	
21. Relative Humidity (%)	—		—		—		—		—	
22.	O_2 Swing		O_2 Swing		O_2 Swing		Capacity Change		100% Capacity	
23.	optimum lo. O_2		lo limit		Hi O_2		(Baseline)			
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/2-13 Date 2-15-78 Location 1 Engr. Tidona

Unit No. 4 Fuel N.G. Capacity 6.5×10^6 BTU/h

Unit Type Research Furnace Burner Type DRA-16 Lo-NOx, Patt I

1. Test No.	1/2-13		1/2-14		1/2-14		1/2-14		1/2-15	
2. Date	2-15-78									→
3. Time	1635		1715		1740		1800		1830	
4. Load										
5. Process Rate	6.5×10^6		3.2×10^6		3.2×10^6		3.2×10^6		1.75×10^6	
6. Flue Diam. or Size, ft	8' X 6'									→
7. Probe Position	center									→
8. Oxygen (%)	2.85-2.85		3.1-3.3		3.45-3.95		3.75		8.90-8.95	
9. NOx (hot) read/3% O_2 (ppm)	86	85	94	95	91	93	89	93	66	93
10. NO (hot) read/3% O_2 (ppm)	86	85	94	95	84	86	88	92	66	93
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	0	0	7	7	1	1	0	0
12. NO (cold) read/3% O_2 (ppm)	113	112	108	109	109	112	109	114	78	110
13. Carbon Dioxide (%)	10.7		10.4		10.6		10.2		6.8	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	39°F		36°F		35°F		35°F		35°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.68		29.68		29.68		29.68		29.68	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	100% Capacity		50% CAP.		50% Cap.		50% Cap		25% CAP.	
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 1/3-1 **Date** 2-16-78 **Location** 1 **Engr.** Tidona

Unit No. **Fuel** **Capacity**

Unit Type **Burner Type** Tertiary Air

1. Test No.	1/3-1		1/3-1		1/3-1		1/3-1		1/3-1	
2. Date	2-16-78								→	
3. Time	1540		1630		1700		1730			
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position										
8. Oxygen (%)	11.6-11.7		10 - 10.35		11 - 11		12 - 12			
9. NOx (hot) read/3% O_2 (ppm)	46	89	49	81	46	83	48	96		
10. NO (hot) read/3% O_2 (ppm)	45	87	49	81	45	81	48	96		
11. NO_2 (hot) read/3% O_2 (ppm)	1	2	0	0	1	2	0	0		
12. NO (cold) read/3% O_2 (ppm)	46	89	48	79	48	86	48	95		
13. Carbon Dioxide (%)	6.4		5.5		5.5		5.5			
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—		
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0		
17. Smoke Spot (Bacharach)	0		0		0		0			
18. Atmos. Temp. (°F/°C)	34°F		32°F		31°F		29°F			
19. Dew Point Temp. (°F/°C)	—		—		—		—			
20. Atmos. Pressure (in. Hg)	29.72		29.72		29.72		29.72			
21. Relative Humidity (%)	—		—		—		—			
22.	HEAT up		HEAT up		HEAT up		HEAT up			
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/3-2 Date FEB 17 1978 Location 1 Engr. Tidona

Unit No. 4 Fuel No 6 oil Capacity 6.5 x 10^6 BTU/H

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	1/3-2 —									→
2. Date	2-17-78									→
3. Time	0900		0930		1010		1040		1115	
4. Load										
5. Process Rate (BTU/H)	5.3x10^6									→
6. Flue Diam. or Size, ft	8'x6'									→
7. Probe Position	CENTER									→
8. Oxygen (%)	3.15-3.30		3.18-3.25		3.0-3.18		2.95 3.02		3.2-3.9	
9. NOx (hot) read/3% O$_2$ (ppm)	250	253	235	238	235	236	247	247	232	239
10. NO (hot) read/3% O$_2$ (ppm)	245	248	235	238	233	234	240	240	225	232
11. NO$_2$ (hot) read/3% O$_2$ (ppm)	5	5	0	0	2	2	7	7	7	7
12. NO (cold) read/3% O$_2$ (ppm)	235	237	245	248	260	261	255	255	250	258
13. Carbon Dioxide (%)	12.8		13.6		14.6		14.0		14.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	1150	1165	1100	1176	1146	1152	1160	1160	1200	1239
17. Smoke Spot (Bacharach)	4		4.5		4		4		3	
18. Atmos. Temp. (°F/°C)	26°F		27°F		26°F		24°F		26°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.78		29.78		29.83		29.83		29.84	
21. Relative Humidity (%)	—		—		—		—		—	
22.	Baseline		Baseline		Baseline		Baseline		Baseline	
23.										
24.	Calibrated Teco in 250 Range Read in 1000 Range									
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/3 - 3 to 6 Date 2-17-78 Location 1 Engr. Tidona

Unit No. 4 Fuel No 6 oil Capacity 6.5 x 10^6 BTU/H

Unit Type RESEARCH FURNACE Burner Type TERTIARY AIR

1. Test No.	1/3-3		1/3-4		1/3-4		1/3-5		1/3-6	
2. Date	2-17-78									→
3. Time	1315		1350		1440		1545		1610	
4. Load										
5. Process Rate	5.3 x 10^6									→
6. Flue Diam. or Size, ft	8' x 6'									→
7. Probe Position	Center									→
8. Oxygen (%)	3.0 - 3.1		.55 - .6		.45 - .45		1.2 — 1.55		4.15 - 4.25	
9. NOx (hot) read/3% O_2 (ppm)	235	236	210	184	205	180	220	202	220	236
10. NO (hot) read/3% O_2 (ppm)	230	231	205	180	190	166	220	202	220	236
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	5	4	15	14	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)	265	266	255	224	254	222	270	248	255	273
13. Carbon Dioxide (%)	13.6		15.0		15.6		14.4		13.2	
14. Carbon Monoxide (ppm) uncor/cor	0	0	30	26	100	88	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	1270	1274	1040	905	1510	1323	1350	1238	1120	1200
17. Smoke Spot (Bacharach)	1		2		3		2		1/2	
18. Atmos. Temp. (°F/°C)	26°F		27°F		26°F		28°F		26°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.83		29.83		29.83		29.83		29.83	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	BASELINE		O_2 Swing		O_2 Swing		O_2 Swing		O_2 Swing	
24.			CO limit		CO limit		optimum low		Hi O_2	
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/3 -7 to 8 Date 2-18-78 Location 1 Engr. Tidona

Unit No. 4 Fuel N.G. Capacity 6.5×10^6 BTU/H

Unit Type RESEARCH FURNACE Burner Type TERTIARY AIR

1. Test No.	1/3-7 →		→		1/3-8 →		→		→	
2. Date	2-18-78		→						→	
3. Time	0830		0900		0955		1030		1100	
4. Load										
5. Process Rate (Bt-/h)	2.37×10^6		—		3.0×10^6		3.25×10^6		3.25×10^6	
6. Flue Diam. or Size, ft	8'×6'		→						→	
7. Probe Position	Center		→						→	
8. Oxygen (%)	3.4 - 3.4		3.15 - 3.15		2.6 - 2.9		2.95-2.95		3.05 - 3.0	
9. NOx (hot) read/3% O_2 (ppm)	91	93	90	91	99	98	94	93	107	107
10. NO (hot) read/3% O_2 (ppm)	85	87	85	86	91	90	88	88	101	101
11. NO_2 (hot) read/3% O_2 (ppm)	6	6	5	5	8	8	6	5	6	6
12. NO (cold) read/3% O_2 (ppm)	100	102	108	109	115	113	107	105	124	124
13. Carbon Dioxide (%)	10.2		10.2		10.6		11.1		10.4	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	19°F		16°F		24°F		24°F		24°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.83		29.83		29.83		29.83		29.83	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.	35% CAP.		35% CAP.		50% CAP		50% CAP		50% CAP	
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/3-8 Date 2-18-78 Location 1 Engr. Tidbury

Unit No. 4 Fuel No.6 Capacity 6.5 X 10^6 BTU/H

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	1/3-8 →									
2. Date	2-18-78		2-18-78							
3. Time	1120		1140							
4. Load										
5. Process Rate Btu/H	3.25×10^6		3.25×10^6							
6. Flue Diam. or Size, ft	8'x6'		8'x6'							
7. Probe Position	Center		Center							
8. Oxygen (%)	3.1 - 3.2		2.95 - 3.15							
9. NOx (hot) read/3% O_2 (ppm)	111	112	106	106						
10. NO (hot) read/3% O_2 (ppm)	103	104	103	103						
11. NO_2 (hot) read/3% O_2 (ppm)	8	8	3	3						
12. NO (cold) read/3% O_2 (ppm)	124	125	124	124						
13. Carbon Dioxide (%)	10.6		10.6							
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0						
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—						
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0						
17. Smoke Spot (Bacharach)	0		0							
18. Atmos. Temp. (°F/°C)	26°F		23°F							
19. Dew Point Temp. (°F/°C)	—		—							
20. Atmos. Pressure (in. Hg)	29.83		29.81							
21. Relative Humidity (%)	—		—							
22.										
23.	50% cap		50% cap							
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/3-9 Date FEB 2 0 1978 Location 1 Engr. Tiobam

Unit No. 4 Fuel N.G. Capacity 6.5×10^6 BtU/H

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	1/3-9									→
2. Date	2-20-78									→
3. Time	0855		1030		1100		1200		1230	
4. Load										
5. Process Rate (Btu/h)	5.2×10^6									→
6. Flue Diam. or Size, ft	8'x6'									→
7. Probe Position	Center									→
8. Oxygen (%)	3.25-4.0		3.5-3.5		3.4-3.4		3.4-3.4		3.5-3.5	
9. NOx (hot) read/3% O_2 (ppm)	119	123	121	124	124	127	121	124	121	124
10. NO (hot) read/3% O_2 (ppm)	111	115	111	114	115	118	113	116	115	118
11. NO_2 (hot) read/3% O_2 (ppm)	8	8	10	10	9	9	8	8	6	6
12. NO (cold) read/3% O_2 (ppm)	134	139	143	147	144	147	135	138	140	144
13. Carbon Dioxide (%)	10.2		10.2		10.2		10.2		10.2	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	33°F		36°F		37°F		34°F		36°F	
19. Dew Point Temp. (°F/°C)	–		–		–		–		–	
20. Atmos. Pressure (in. Hg)	29.37		29.43		29.43		29.43		29.43	
21. Relative Humidity (%)	–		–		–		–		–	
22.										
23.	Baseline		Baseline		Baseline		Baseline		Baseline	
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.**________

Test No. 1/3-10 to 13 **Date** 2-20-78 **Location** 1 **Engr.** Tidona

Unit No. 4 **Fuel** N.6. **Capacity** 6.5 X 10⁶ Btu/H

Unit Type Research Furnace **Burner Type** Tertiary Air

1. Test No.	1/3-10		1/3-11 →		→		1/3-12		1/3-13	
2. Date	2-20-78		→							
3. Time	1345		1410		1435		1450		1520	
4. Load										
5. Process Rate	5.2 x 10⁶		→							
6. Flue Diam. or Size, ft	8' x 6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	.30 - .50		.90 - 1.0		.90 - .85		2.0 - 2.1		4.1	
9. NOx (hot) read/3% O_2 (ppm)	118	104	111	100	115	103	120	114	121	128
10. NO (hot) read/3% O_2 (ppm)	115	101	105	94	108	96	113	107	111	118
11. NO_2 (hot) read/3% O_2 (ppm)	3	3	6	6	7	7	7	7	10	10
12. NO (cold) read/3% O_2 (ppm)	135	117	140	126	138	123	148	141	139	148
13: Carbon Dioxide (%)	11.3		11.6		11.6		11.2		10.2	
14. Carbon Monoxide (ppm) uncor/cor	95	83	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	33°F		32°F		32°F		32°F		33°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.46		29.48		29.50		29.50		29.52	
21. Relative Humidity (%)	—		—		—		—		—	
22.	O_2 Swing		O_2 Swing		→		O_2 Swing		O_2 Swing	
23.	(Lo limit)		(opt. low)				(Med. Low)		High O_2	
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 1/3-13 to 14 Date 2-20-78 Location 1 Engr. Tidona

Unit No. 4 Fuel N.G. Capacity 6.5 X 10^6

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	1/3-13		1/3-14		1/3-14		1/3-14			
2. Date	2-20-78								→	
3. Time	1560		1700		1730		1755			
4. Load										
5. Process Rate	5.2 x 10^6		6.5 x 10^6						→	
6. Flue Diam. or Size, ft	8' x 6'								→	
7. Probe Position	center								→	
8. Oxygen (%)	3.9–4.0		3.35-3.35		3.3-3.3		2.95-3.00			
9. NOx (hot) read/3% O_2 (ppm)	121	128	121	123	132	134	131	131		
10. NO (hot) read/3% O_2 (ppm)	111	117	115	117	121	123	125	125		
11. NO_2 (hot) read/3% O_2 (ppm)	10	11	6	6	11	11	6	6		
12. NO (cold) read/3% O_2 (ppm)	141	149	140	143	145	147	148	148		
13. Carbon Dioxide (%)	10.2		10.3		10.3		10.2			
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—		
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0		
17. Smoke Spot (Bacharach)	0		0		0		0			
18. Atmos. Temp. (°F/°C)	32°F		29°F		28°F		28°F			
19. Dew Point Temp. (°F/°C)	—		—		—		—			
20. Atmos. Pressure (in. Hg)	29.53		29.55		29.55		29.55			
21. Relative Humidity (%)	—		—		—		—			
22.	O_2 Swing Hi O_2		100% cap.		100% cap.		100% cap.			
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/3-15 to 19 Date 2-22-78 Location 1 Engr. T. Logan

Unit No. 4 Fuel Shale oil (Rated) Capacity 6.5 x10⁶ Btu/h

Unit Type RESEARCH FURNACE Burner Type TERTIARY AIR (LO-NOx)

1. Test No.	1/3-15		1/3-16		1/3-17		1/3-18		1/3-19	
2. Date	2-22-78		2-22-78		2-22-78		2-22-78		2-22-78	
3. Time	1100		11:15		11:30		11:40		11:45	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	6.45		3.15		1.95		0.35		1.20	
9. NOx (hot) read/3% O_2 (ppm)	–	–	–	–	–	–	–	–	–	–
10. NO (hot) read/3% O_2 (ppm)	–	–	–	–	–	–	–	–	–	–
11. NO_2 (hot) read/3% O_2 (ppm)	–	–	–	–	–	–	–	–	–	–
12. NO (cold) read/3% O_2 (ppm)	425	526	435	439	385	364	230	200	325	295
13. Carbon Dioxide (%)	–		–		–		–		–	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	>2000	–	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	–	–	–	–	200	188	–	–	–	–
17. Smoke Spot (Bacharach)	–		–		–		–		–	
18. Atmos. Temp. (°F/°C)	50°F		→							
19. Dew Point Temp. (°F/°C)	–		–		–		–		–	
20. Atmos. Pressure (in. Hg)	29.56		→							
21. Relative Humidity (%)	–		–		–		–		–	
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.**

Test No. 1/3-20 & 21 **Date** 2-22-78 **Location** 1 **Engr.**

Unit No. 4 **Fuel** Shale Oil **Capacity**

Unit Type **Burner Type** TERTIARY AIR

1. Test No.	1/3-20				1/3-21					
2. Date	2-22-78				2-22-78					
3. Time	12:00				10:30					
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'				8'x6'					
7. Probe Position	Center				Center					
8. Oxygen (%)	2.95				3.4					
9. NOx (hot) read/3% O_2 (ppm)	308	307			–	–				
10. NO (hot) read/3% O_2 (ppm)	290	289			–	–				
11. NO_2 (hot) read/3% O_2 (ppm)	18	18			–	–				
12. NO (cold) read/3% O_2 (ppm)	330	329			145	148				
13. Carbon Dioxide (%)	–				–					
14. Carbon Monoxide (ppm) uncor/cor	0	0			0	0				
15. Hydrocarbon (ppm) uncor/cor	–	–			–	–				
16. Sulfur Dioxide (ppm) uncor/cor	–	–			–	–				
17. Smoke Spot (Bacharach)	–				–					
18. Atmos. Temp. (°F/°C)	50°F				50°F					
19. Dew Point Temp. (°F/°C)	–				–					
20. Atmos. Pressure (in. Hg)	29.56				29.56					
21. Relative Humidity (%)	–				–					
22.					NATURAL					
23.					GAS					
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/3-22&23 Date 2-22-78 Location 1 Engr. Tidona

Unit No. 4 Fuel No 6 oil Capacity 6.5 X10^6 BTU/H

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	1/3-22		1/3-23				
2. Date	2-21-78		—				→
3. Time	1655		1755				
4. Load							
5. Process Rate BTU/H	5×10^6		—				→
6. Flue Diam. or Size, ft	8'×6'		—				→
7. Probe Position	Center		—				→
8. Oxygen (%)	3.0		3.2-3.2				
9. NOx (hot) read/3% O_2 (ppm)	230	230	187	189			
10. NO (hot) read/3% O_2 (ppm)	230	230	185	187			
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	2	2			
12. NO (cold) read/3% O_2 (ppm)	260	260	190	192			
13. Carbon Dioxide (%)	13.6		12.6				
14. Carbon Monoxide (ppm) uncor/cor	10	0	0	0			
15. Hydrocarbon (ppm) uncor/cor	—	—	-	-			
16. Sulfur Dioxide (ppm) uncor/cor	1200	1200	1080	1092			
17. Smoke Spot (Bacharach)	.5		1				
18. Atmos. Temp. (°F/°C)	54		54				
19. Dew Point Temp. (°F/°C)	—		-				
20. Atmos. Pressure (in. Hg)	29.57		29.57				
21. Relative Humidity (%)	—		-				
22.							
23.							
24.	All						
25.	Registers						
26.	100% open						
27.							
28.							
29.							
30.	B.L						

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. Y3-24b26 Date 2-23-7 Location 1 Engr. Tiriana

Unit No. 4 Fuel No 6 Oil Capacity 6.5 x 10^6 BTU/H

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	Y -24a		→		Y3-24b		Y3-25		Y3-26	
2. Date	2-23-78								→	
3. Time	1210		1415		1525		1545		1605	
4. Load										
5. Process Rate BTU/H	5 x 10^6								→	
6. Flue Diam. or Size, ft	8' x 6'								→	
7. Probe Position	Center								→	
8. Oxygen (%)	3.0-3.05		3.1-3.2		3.45-4.0		2.95-3.4		2.75-3.0	
9. NOx (hot) read/3% O_2 (ppm)	74	74	69	70	81	84	79	80	79	78
10. NO (hot) read/3% O_2 (ppm)	69	69	67	68	76	79	78	79	75	74
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	2	2	5	5	1	1	4	4
12. NO (cold) read/3% O_2 (ppm)	75	75	74	75	89	93	93	84	81	80
13. Carbon Dioxide (%)	10.6		9.9		10.2		10.6		11.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	54°F		57°F		55°F		55°F		55°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.73		29.73		29.68		29.68		29.68	
21. Relative Humidity (%)	—		—		—		—		—	
22.	Baseline		Baseline		Baseline		Primary air closed		Primary 50% open	
23.	(Firebox at		low temp.)		(Firebox at					
24.					higher temp)					
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. Y3-27 to 30 Date 2-23-78 Location 1 Engr. Tidona

Unit No. 4 Fuel No 6 oil Capacity 6.5 X 10⁶ Btu/H

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	Y3-27		Y3-28		Y3-29		Y3-30		Y3-30	
2. Date	2-23-78								→	
3. Time	1625		1645		1705		1730		1745	
4. Load										
5. Process Rate Btu/H	5 X 10⁶								→	
6. Flue Diam. or Size, ft	8'X6'								→	
7. Probe Position	Center								→	
8. Oxygen (%)	3.0 - 3.0		3.0 - 3.4		3.15 - 3.3		3.0 - 3.05		2.8 - 2.9	
9. NOx (hot) read/3% O_2 (ppm)	75	75	95	96	84	85	79	79	78	77
10. NO (hot) read/3% O_2 (ppm)	71	71	93	94	80	81	78	78	75	74
11. NO_2 (hot) read/3% O_2 (ppm)	4	4	2	2	4	4	1	1	3	3
12. NO (cold) read/3% O_2 (ppm)	83	83	91	92	89	90	85	85	84	83
13. Carbon Dioxide (%)	11.0		10.2		10.2		10.6		11.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	56°F		55°F		56°F		54 °F		54°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.68		29.68		29.68		29.68		29.68	
21. Relative Humidity (%)	—		—		—		—		—	
22.	Secondary closed		Secondary 50% open		Pri + Sec 50% open		Pri closed Sec. 50% open		Pri. closed Sec. 50% open	
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.**

Test No. 1/3-31 to 35 **Date** 2-23-78 **Location** 1 **Engr.** Tidball

Unit No. 4 **Fuel** No 6 oil **Capacity** 6.5 x 10⁶ BTU/H

Unit Type Research Furnace **Burner Type** Tertiary Air

1. Test No.	1/3-31		1/3-32		1/3-33		1/3-34		1/3-35	
2. Date	2-23-78								→	
3. Time	1755		1825		1840		1915		1950	
4. Load										
5. Process Rate BTU/h	5×10^6								→	
6. Flue Diam. or Size, ft	8' x 6'								→	
7. Probe Position	center								→	
8. Oxygen (%)	3.3 - 3.4		3.4 - 3.5		2.6-2.8		2.05-2.05		3.8 - 4.4	
9. NOx (hot) read/3% O_2 (ppm)	83	85	89	91	88	87	75	71	94	100
10. NO (hot) read/3% O_2 (ppm)	80	82	89	91	83	82	75	71	93	99
11. NO_2 (hot) read/3% O_2 (ppm)	3	3	0	0	5	5	0	0	1	1
12. NO (cold) read/3% O_2 (ppm)	84	86	94	96	95	93	80	76	96	102
13. Carbon Dioxide (%)	10.6		10.3		10.6		10.6		9.8	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	50	47	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	52°F		52°F		51°F		50°F		47°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.68		29.68		29.68		29.68		29.68	
21. Relative Humidity (%)	—		—		—		—		—	
22.	Primary closed		All secondary Half open		Baseline		O_2 Swing		O_2 Swing	
23.	Tertiary Half open						Co limits		Hi O_2	
24.										
25.							Checked Teiko			
26.							O_2 instrument with portable			
27.							O_2 inst. Read 1.8% on the			
28.							portable inst.			
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. Y3-36 to 38 Date 2-23-78 Location 1 Engr. Tidona

Unit No. 4 Fuel No 6 oil Capacity 6.5 X 10⁶ Btu/H

Unit Type RESEARCH FURNACE Burner Type TERTIARY AIR

1. Test No.	Y3-36		Y3-37		Y3-38					
2. Date	2-23-78									→
3. Time	2015		2050		2115					
4. Load										
5. Process Rate Btu/H	5 x 10⁶									→
6. Flue Diam. or Size, ft	8'x6'									→
7. Probe Position	center									→
8. Oxygen (%)	3.2-3.2		3.7	4.05	2.2-2.2					
9. NOx (hot) read/3% O_2 (ppm)	83	84	85	89	73	70				
10. NO (hot) read/3% O_2 (ppm)	76	76	85	89	73	70				
11. NO_2 (hot) read/3% O_2 (ppm)	8	8	0	0	0	0				
12. NO (cold) read/3% O_2 (ppm)	91	92	100	105	78	75				
13. Carbon Dioxide (%)	10.6		10.3		11.0					
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	60	57				
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–				
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0				
17. Smoke Spot (Bacharach)	0		0		0					
18. Atmos. Temp. (°F/°C)	47° F		47° F		47° F					
19. Dew Point Temp. (°F/°C)	—		—		—					
20. Atmos. Pressure (in. Hg)	29.68		29.68		29.68					
21. Relative Humidity (%)	—		—							
22.	PRIMARY 50% OPEN		PRIMARY AIR 50% OPEN		PRIMARY AIR 50% OPEN					
23.	AT 3% O_2		AT 4% O_2		AT CO LIMIT					
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No 1/3-39 to 43 Date 2-24-78 Location 1 Engr. Tidona

Unit No. 4 Fuel No # 6 oil Capacity 6.5 X 10^6 BTU/H

Unit Type Research Furnace Burner Type Tertiary Air

1. Test No.	1/3-39		1/3-40		1/3-41		1/3-42		1/3-43	
2. Date	2-24-78									
3. Time	1050		1125		1230		1250		1320	
4. Load										
5. Process Rate BTU/H	5 x 10^6									
6. Flue Diam. or Size, ft	8'x6'									
7. Probe Position	center									
8. Oxygen (%)	2.95-3.3		3.0- 3.6		2.7-3.05		2.7-2.7		2.5-2.7	
9. NOx (hot) read/3% O_2 (ppm)	245	247	170	173	218	216	214	210	235	230
10. NO (hot) read/3% O_2 (ppm)	240	242	170	173	215	214	205	202	235	230
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	0	0	3	2	9	8	0	0
12. NO (cold) read/3% O_2 (ppm)	260	262	195	198	250	248	256	251	280	275
13. Carbon Dioxide (%)	13.6		14.0		14.0		14.0		14.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	1140	1150	1060	1078	1010	1003	1028	1011	740	728
17. Smoke Spot (Bacharach)	2		3		1		1/2		—	
18. Atmos. Temp. (°F/°C)	61°F		65°F		65°F		69°		69°	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.45		29.45		29.45		29.45		29.45	
21. Relative Humidity (%)	—		—		—		—		—	
22.	Baseline		Primary		Primary		Pri & Sec		Sec. closed	
23.			10% open		50% open		50% open			
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.**________

Test No. 1/3 - 44 to 45 **Date** 2-24-78 **Location**________ **Engr.** Tidona

Unit No. 4 **Fuel** No # 6 oil **Capacity** 6.5 x 10⁶ BTU/H

Unit Type Research Furnace **Burner Type** Tertiary Air

1. Test No.	1/3-44		1/3-45				
2. Date	2-24-78						→
3. Time	1345		1355				
4. Load							
5. Process Rate Btu/H	5 x 10⁶						→
6. Flue Diam. or Size, ft	8' x 6'						→
7. Probe Position	center						→
8. Oxygen (%)	2.9		3.0 -3.85				
9. NOx (hot) read/3% O_2 (ppm)	170	169					
10. NO (hot) read/3% O_2 (ppm)	165	164					
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	0	0			
12. NO (cold) read/3% O_2 (ppm)	195	194	200	205			
13. Carbon Dioxide (%)	14.0		13.2				
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0			
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—			
16. Sulfur Dioxide (ppm) uncor/cor	820	815	700	717			
17. Smoke Spot (Bacharach)	1		1/2				
18. Atmos. Temp. (°F/°C)	77°F		77°F				
19. Dew Point Temp. (°F/°C)	—		—		--		
20. Atmos. Pressure (in. Hg)	29.40		29.40				
21. Relative Humidity (%)	—		—		—		
22.							
23.	O_2 Swing @		O_2 Swing @				
24.	OPTIMUM REG SETTING		Off optimum REG setting				
25.	(3% O_2)		(4% O_2)				
26.							
27.							
28.							
29.							
30.							

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No. 1/4-1 to 1/4-4 Date 3-13-78 Location 1 Engr. Buening

Unit No.________ Fuel N.G. Capacity________

Unit Type Research Furnace Burner Type MA-16 Patt. II

1. Test No.	1/4-1		1/4-1		1/4-2		1/4-3		1/4-4	
2. Date	3-13-78		→							
3. Time	1330		1400		1430		1450		1515	
4. Load BTUH x 10^6	5.25		5.32		5.2		5.25		5.35	
5. Process Rate										
6. Flue Diam. or Size, ft	6' x 8'		→							
7. Probe Position	℄		℄		℄		℄		℄	
8. Oxygen (%)	3.0-2.6		3.5-3.5		2.5-2.7		2.6-2.9		2.8-3.0	
9. NOx (hot) read/3% O_2 (ppm)	78	79	81	83	85	83	94	93	91	90
10. NO (hot) read/3% O_2 (ppm)	73	74	78	80	83	81	93	92	88	88
11. NO_2 (hot) read/3% O_2 (ppm)	5	5	3	3	2	2	1	1	3	2
12. NO (cold) read/3% O_2 (ppm)	90	92	93	96	100	98	105	104	109	108
13. Carbon Dioxide (%)	10.6		10.2		10.2		10.6		11.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	56		56		59		58		61	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	28.9		28.9		28.9		28.9		28.9	
21. Relative Humidity (%)	—		—		—		—		—	
22.					100% prim. air 50% sec. air					
23.							100% prim. air 20% sec. air		50% prim. air 50% sec. air	
24.	Baseline		Baseline							
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. V4-5 Date 3-13-78 Location 1 Engr. Buening

Unit No.________ Fuel NG Capacity________

Unit Type Research Furnace Burner Type MA-16 Part II

1. Test No.	V4-5					
2. Date	3-13-78					
3. Time	1610					
4. Load BTU/hr 10^6	5.35					
5. Process Rate						
6. Flue Diam. or Size, ft	8'x6'					
7. Probe Position	℄					
8. Oxygen (%)	2.9 - 3.0					
9. NOx (hot) read/3% O_2 (ppm)	73	73				
10. NO (hot) read/3% O_2 (ppm)	68	68				
11. NO_2 (hot) read/3% O_2 (ppm)	5	5				
12. NO (cold) read/3% O_2 (ppm)	108	108				
13. Carbon Dioxide (%)	9.9					
14. Carbon Monoxide (ppm) uncor/cor	0	0				
15. Hydrocarbon (ppm) uncor/cor	—	—				
16. Sulfur Dioxide (ppm) uncor/cor	0	0				
17. Smoke Spot (Bacharach)	—					
18. Atmos. Temp. (°F/~~°C~~)	60					
19. Dew Point Temp. (°F/°C)	—					
20. Atmos. Pressure (in. Hg)	28.9					
21. Relative Humidity (%)	—					
22.	Base line					
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No.__________ Date 3-13-78 Location 1 Engr. Reening

Unit No.__________ Fuel N.G. Capacity__________

Unit Type Research Furnace Burner Type MA-16 Patt. II

1. Test No.	1/5-1		1/5-2		1/5-3		1/5-4			
2. Date	3-13-78		→							
3. Time										
4. Load BTu/Hr 10^6	~5.3		→							
5. Process Rate										
6. Flue Diam. or Size, ft	8x6'		→							
7. Probe Position	℄		→							
8. Oxygen (%)	3.4-3.45		30-3.6		2.75-2.9		3.2-3.2			
9. NOx (hot) read/3% O_2 (ppm)	63	64	63	64	64	63	78	79		
10. NO (hot) read/3% O_2 (ppm)	63	64	63	64	64	63	78	79		
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	0	0	0	0	0	0		
12. NO (cold) read/3% O_2 (ppm)	6235	64	59	60	70	69	88	89		
13. Carbon Dioxide (%)	9.95		9.95		10.6		11.3			
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—		
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0		
17. Smoke Spot (Bacharach)	—		—		—		—			
18. Atmos. Temp. (°F/°C)	54°F		54°F		54°F		54°F			
19. Dew Point Temp. (°F/°C)	—		—		—		—			
20. Atmos. Pressure (in. Hg)	29.0		29.0		29.0		29.0			
21. Relative Humidity (%)	—		—		—		—			
22.	50#/Hr.		75#/Hr.		50#/Hr.		Baseline			
23.	Steam		Steam		Steam		No steam			
24.	injection		injection		injection					
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/4-6 to 1/4-9 Date 3-14-78 Location 1 Engr. Roening

Unit No.________ Fuel N.G. Capacity________

Unit Type Research Furnace Burner Type MA-16 Patt. II

1. Test No.	1/6-1		1/6-.1		1/6-2		1/6-3		1/6-4	
2. Date	3-14-78									→
3. Time	0930		1000		1050		11:45		1315	
4. Load BTUH×10⁶	5.4		5.35		5.22		5.0		4.67	
5. ~~Process Rate~~ ΔH "H₂O	-		-		1.9		1.9		1.9	
6. ~~Flue Diam. or Size, ft~~ burner Φ	1.16		1.17		.85		.88		.8	
7. Probe Position	center									→
8. Oxygen (%)	3.1 - 3.25		3.2 - 3.3		2.8 - 3.2		3.4 - 3.9		2.5 - 2.7	
9. NOx (hot) read/3% O_2 (ppm)	81	82	84	85	61	61	63	65	53	52
10. NO (hot) read/3% O_2 (ppm)	81	82	83	84	60	60	60	62	53	52
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	1	1	1	1	3	3	0	0
12. NO (cold) read/3% O_2 (ppm)	101	102	100	101	73	73	69	72	63	62
13. Carbon Dioxide (%)	9.9		10.2		10.2		9.9		10.4	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	51		51		56		57		68	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.3		29.35		29.35		29.35		29.35	
21. Relative Humidity (%)	—		—		—		—		—	
22.	Baseline		Baseline		High staged air 2' in norm. O_2		High staged air 3' in norm. O_2		High staged air 4' in norm. O_2	
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No. 1/4-10 to 1/4-14 Date 3-19-78 Location 1 Engr. Duening

Unit No.________ Fuel N.G Capacity________

Unit Type Research Furnace Burner Type MA-16 Patt. #2

1. Test No.	1/6-5		1/6-6		1/6-7		1/6-8		1/6-9	
2. Date	3-14-78		→							
3. Time	1335		1410		1450		1510		1535	
4. Load BTU/Hr x 10⁶	4.97		5.36		5.28		5.21		4.93	
5. Process Rate ΔH	1.9		1.9		1.5		1.5		–	
6. Flue Diam. or Size, ft Ī Ø	.84		.75		.78		.87		1.12	
7. Probe Position	center		center		→					
8. Oxygen (%)	2.9-3.0		.75-1.1		1.0-1.25		2.6-2.8		2.5-2.5	
9. NOx (hot) read/3% O_2 (ppm)	56	56	36	33	38	34	64	63	98	95
10. NO (hot) read/3% O_2 (ppm)	56	56	35	32	38	34	61	60	95	92
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	1	1	0	0	3	3	3	3
12. NO (cold) read/3% O_2 (ppm)	65	65	43	39	45	41	76	75	119	116
13. Carbon Dioxide (%)	10.6		11.3		13.6		10.6		10.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	–		–		–		–		–	
18. Atmos. Temp. (°F/~~°C~~)	68		77		82		85		72	
19. Dew Point Temp. (°F/°C)	–		–		–		–		–	
20. Atmos. Pressure (in. Hg)	29.35		29.35		29.35		29.35		29.35	
21. Relative Humidity (%)	–		–		–		–		–	
22.	High staged air 5" in norm. O2		High staged air 5" in low O2		Low staged air 5" in low O2		Low staged air 5" in norm. O2		Baseline	
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/4-15 Date 3-15-78 Location 1 Engr. Buening

Unit No.________ Fuel #6 oil Capacity________

Unit Type Research furnace Burner Type MA-16 764 Tip

1. Test No.	1/6-10		1/6-10		1/6-11			
2. Date	3-15-78		→		→			
3. Time	0950		1015		1045			
4. Load BTU/Hr x 10^6	5.48		5.46		5.39			
5. ~~Process Rate~~ Dist. in	–		–		3'			
6. ~~Flue Diam. or Size, ft~~ Φ	1.23		1.28		.92			
7. Probe Position	center		→		→			
8. Oxygen (%)	2.6–2.65		3.25–3.35		2.7–2.7			
9. NOx (hot) read/3% O_2 (ppm)	260	255	245	249	160	157		
10. NO (hot) read/3% O_2 (ppm)	260	255	240	244	155	152		
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	5	5	5	5		
12. NO (cold) read/3% O_2 (ppm)	300	294	285	290	180	177		
13. Carbon Dioxide (%)	12.4		13.2		14.8			
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–		
16. Sulfur Dioxide (ppm) uncor/cor	–	–	–	–	–	–		
17. Smoke Spot (Bacharach)	0		0		3			
18. Atmos. Temp. (°F/°C)	44		46		49			
19. Dew Point Temp. (°F/°C)	–		–		–			
20. Atmos. Pressure (in. Hg)	29.47		29.47		29.47			
21. Relative Humidity (%)	–		–		–			
22.	Baseline		Base line		High Staged Air Normal O_2			
23.								
24.								
25.								
26.								
27.								
28.								
29.								
30.								

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/4-17 to 1/4-20 Date 3-16-78 Location 1 Engr. Buening

Unit No.________ Fuel #6 oil Capacity________

Unit Type Research Furnace Burner Type MA-16 764 Tip

1. Test No.	1/6-12		1/6-12		1/6-13		1/6-14		1/6-15 →	
2. Date	3-16-78									
3. Time	1020		1105		1125		1225		1245	
4. Load BTU/Hr × 10⁶	4.77		4.91		4.9		4.9		5.09	
5. ~~Process Rate~~ ΔH "H₂O	–		–		2.15		2.05		1.45	
6. ~~Flue Diam. or Size,~~ ft ℄	1.29		1.26		0.9		0.78		0.85	
7. Probe Position	℄		℄		℄		℄		℄	
8. Oxygen (%)	3.3 – 3.6		3.0 – 3.0		3.0 – 3.2		.95 – 1.05		1.0 – 1.0	
9. NOx (hot) read/3% O_2 (ppm)	240	246	270	270	280	282	140	126	170	153
10. NO (hot) read/3% O_2 (ppm)	230	236	265	265	275	277	135	122	165	149
11. NO_2 (hot) read/3% O_2 (ppm)	10	10	5	5	5	5	5	4	5	4
12. NO (cold) read/3% O_2 (ppm)	290	297	300	300	1.95	1.96	160	144	180	162
13. Carbon Dioxide (%)	10.8		13.6		14.6		15.6		15.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	1030	1056	1000	1000	1090	1096	1160	1044	1240	1116
17. Smoke Spot (Bacharach)	4		4		8		7		7	
18. Atmos. Temp. (°F/°C)	51		53		55		57		58	
19. Dew Point Temp. (°F/°C)	–		–		–		–		–	
20. Atmos. Pressure (in. Hg)	29.80		29.80		29.80		29.80		29.80	
21. Relative Humidity (%)	–		–		–		–		–	
22.	Baseline		Baseline							
23. Stack appearance					clear		clear		clear	
24.					High S.A.	Norm. O₂	High S.A.	Low O₂	Low S.A.	Low O₂
25.										
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/4-21 to Date 3-16-78 Location 1 Engr. Boening

Unit No.________ Fuel #6 oil Capacity________

Unit Type Research Furnace Burner Type MA-16 - Tip 764

1. Test No.	1/6 - 16		1/6 - 17		1/6 - 18		1/6 - 19		
2. Date	3-16-78		—		—		→		
3. Time	1640		1720		1745		1805		
4. Load BTU/Hr x 10^6	5.46		5.41		5.22		5.29		
5. Process Rate ΔH "H_2O	1.55		1.55		2.1		-		
6. Flue Diam. or Size, ft ∅	0.99		1.03		0.98		1.25		
7. Probe Position	℄		℄		℄		℄		
8. Oxygen (%)	3.0 - 3.6		3.9 - 3.9		4.0 - 4.2		3.0 - 3.4		
9. NOx (hot) read/3% O_2 (ppm)	190	193	195	205	195	208	233	236	
10. NO (hot) read/3% O_2 (ppm)	190	193	195	205	195	208	230	233	
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	0	0	0	0	3	3	
12. NO (cold) read/3% O_2 (ppm)	200	203	215	226	210	224	260	263	
13. Carbon Dioxide (%)	13.6		12.8		12.8		13.6		
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	
16. Sulfur Dioxide (ppm) uncor/cor	960	976	920	968	900	959	840	849	
17. Smoke Spot (Bacharach)	3		8		3		2		
18. Atmos. Temp. (°F/°C)	52		53		52		50		
19. Dew Point Temp. (°F/°C)	—		—		—		—		
20. Atmos. Pressure (in. Hg)	29.75		29.75		29.75		29.75		
21. Relative Humidity (%)	—		—		—		—		
22.							Baseline		
23. Stack opacity	clear		clear		clear		clear		
24.	Low staged air normal O_2		Low S.A. Hi O_2		Hi S.A. Hi O_2				
25.									
26.									
27.									
28.									
29.									
30.									

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No.__________ Date 3-21-78 Location 1 Engr. K.

Unit No.__________ Fuel N.G. Capacity__________

Unit Type Research Furnace Burner Type MA-16 Pcl. II

1. Test No.	1/7-1		1/7-1		1/7-2		1/7-3		1/7-4	
2. Date	3/21/78		3/21/78		3/21/78		3/21/78		3/21/78	
3. Time	0950		1020		1100		1240		1300	
4. Load x 10⁶ BTU/H	5.17		5.2		4.99		5.13		5.22	
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		8'x6'		8x6		8'x6'		8x6	
7. Probe Position	℄		℄		℄		℄		℄	
8. Oxygen (%)	2.9		3.1		2.8		2.8		2.9	
9. NOx (hot) read/3% O_2 (ppm)	72	72	78	78	65	64	61	61	67	67
10. NO (hot) read/3% O_2 (ppm)	71	71	76	76	64	63	59	59	66	66
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	2	2	1	1	2	2	1	1
12. NO (cold) read/3% O_2 (ppm)	88	88	95	95	79	78	74	74	83	83
13. Carbon Dioxide (%)	10.6		10.7		10.6		10.6		10.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	I0	05	—	—	—	—	—	—		
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	64		64		69		75		75	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.50		29.50		29.50		29.50		29.5	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.										
24.										
25.					Flue Gas					
26.					Recirc.					
27.	Baseline		Baseline		Shed @ 19.1 O_2		FGR		FGR^2	
28.			Repeat		Plenum					
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. Date MAR 21 1978 Location 1 Engr. Ki

Unit No. Fuel N.G. Capacity

Unit Type Research Furnace Burner Type MA-16 Pattern II

1. Test No.	1/7-5		1/7-6		1/7-7		1/7-8		1/7-9	
2. Date	3/21/78		→							
3. Time	1450		1510		1530		1600		1630	
4. Load BTU/Hr x 10⁶	4.81		4.82		4.83		5.22		5.38	
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'		8'x6'		8'x6'		8'x6'		8'x6'	
7. Probe Position	℄		℄		℄		℄		℄	
8. Oxygen (%)	2.1		3.0		2.1		0.7		3.4	
9. NOx (hot) read/3% O_2 (ppm)	37	35	40	40	40	38	41	36	87	92
10. NO (hot) read/3% O_2 (ppm)	36	34	39	39	40	38	40	35	90	89
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	1	1	0	0	1	1	3	3
12. NO (cold) read/3% O_2 (ppm)	44	42	47	47	49	47	47	42	110	112
13. Carbon Dioxide (%)	11.2		10.8		11.2		17.9		10.8	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	35	31	0	0
15. Hydrocarbon (ppm) uncor/cor	—	I005	→							
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	88		99		77		82		77	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.49		29.49		29.49		29.49		29.49	
21. Relative Humidity (%)	—		—		—		—		—	
22.										
23.									Baseline	
24.										
25.	FGR low O_2		FGR		FGR low O_2		FGR low O_2			
26.										
27.										
28.							CO Limit			
29.							@ 7% Cr			
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No.________ Date MAR 22 1978 Location 1 Engr. WAC

Unit No.________ Fuel #6 Oil Capacity________

Unit Type Research Furnace Burner Type MA-16

1. Test No.	1/7 - 10		1/7 - 10		1/7 - 11		1/7 - 12		1/7 - 13	
2. Date	3-22-78								→	
3. Time	1000		1040		1120		1150		1225	
4. Load Btu/Hr x10^6	4.99		5.02		4.98		4.99		5.05	
5. Process Rate										
6. Flue Diam. or Size, ft	8'x6'								→	
7. Probe Position	℄		℄		℄		℄		℄	
8. Oxygen (%)	2.8 - 3.2		3.0		3.0 - 3.3		2.8-3.2		2.8-3.2	
9. NOx (hot) read/3% O_2 (ppm)	210	210	220	220	172	173	161	161	152	152
10. NO (hot) read/3% O_2 (ppm)	200	200	211	211	170	171	158	158	150	150
11. NO_2 (hot) read/3% O_2 (ppm)	10	10		9	2	2	3	3	2	2
12. NO (cold) read/3% O_2 (ppm)	240	240	242	242	190	192	180	180	172	172
13. Carbon Dioxide (%)	13.6		13.6		13.2		13.2		13.2	
14. Carbon Monoxide (ppm) uncor/cor	0		0		0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	I005								→	
16. Sulfur Dioxide (ppm) uncor/cor	560	560	510	510	005		005		005	
17. Smoke Spot (Bacharach)	4		4½		2½		4		4	
18. Atmos. Temp. (°F/~~°C~~)	71		-		75		78		79	
19. Dew Point Temp. (°F/°C)	-		-		-		-		-	
20. Atmos. Pressure (in. Hg)	29.45		29.45		29.45		29.44		29.42	
21. Relative Humidity (%)	-		-		-		-		-	
22.										
23.										
24.										
25.										
26.										
27.					3% O_2 Stack		FGR		FGR	
28.							18% O_2			
29.							3% O_2 Stack			
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. Date Location 1 Engr.

Unit No. Fuel No.6 Oil Capacity

Unit Type Rosemount Furnace Burner Type MA 16-

1. Test No.	1/7-14		1/7-15		1/7-16		1/7-17		1/7-18	
2. Date	3-22-78		→							
3. Time	1240		1300		1330		1500		1530	
4. Load BTU/Hr x 10⁶	5.22		5.22		4.99		4.96		5.02	
5. Process Rate										
6. Flue Diam. or Size, ft	8' x 6'		→							
7. Probe Position	8		→							
8. Oxygen (%)	1.8-2.1		1.9-2.0		1.9-2.1		0.8		.95	
9. NOx (hot) read/3% O_2 (ppm)	143	135	157	149	179	170	164	146	140	125
10. NO (hot) read/3% O_2 (ppm)	141	134	155	147	175	166	162	144	135	120
11. NO_2 (hot) read/3% O_2 (ppm)	2	1	2	2	4	4	2	2	5	5
12. NO (cold) read/3% O_2 (ppm)	164	155	180	170	200	189	190	169	160	142
13. Carbon Dioxide (%)	13.6		13.0		13.4		15.0		14.1	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0		0		10	9	10	9
15. Hydrocarbon (ppm) uncor/cor	005		005		005		005		005	
16. Sulfur Dioxide (ppm) uncor/cor	005		005		005		005		005	
17. Smoke Spot (Bacharach)	5		4		4		6		4	
18. Atmos. Temp. (°F/°C)	80		81		81		89		86	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.40		29.40		29.39		29.32		29.32	
21. Relative Humidity (%)	—		—		—		—		—	
22.							CO Limit			
23.							4 %			
24.							15.7% O2 plenum .8% O2 stack			
25.										
26.	FGR		FGR		FGR				18% O2 Plenum	
27.	17% Plenum		18% Plenum		18% Plenum				.95% O2 Stack	
28.	2% Stack		2% Stack		2% Stack					
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No.________ Date MAR 22 1978 Location 1 Engr.________

Unit No.________ Fuel #6 oil Capacity________

Unit Type Research Furnace Burner Type MA-1L 764 nozzle

1. Test No.	1/7-19		1/7-20							
2. Date	3-22-78		3-22-78							
3. Time	1550		1645							
4. Load BTU/Hr x 10⁶	4.94		5.04							
5. Process Rate										
6. Flue Diam. or Size, ft	8' x 6'		8' x 6'							
7. Probe Position	℄		℄							
8. Oxygen (%)	1.0		2.5							
9. NOx (hot) read/3% O_2 (ppm)	152	137	203	198						
10. NO (hot) read/3% O_2 (ppm)	150	135	200	194						
11. NO_2 (hot) read/3% O_2 (ppm)	2	2	3	4						
12. NO (cold) read/3% O_2 (ppm)	170	153	243	236						
13. Carbon Dioxide (%)	13.8		13.8							
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0						
15. Hydrocarbon (ppm) uncor/cor	00	5	00	5						
16. Sulfur Dioxide (ppm) uncor/cor	00	5	00	5						
17. Smoke Spot (Bacharach)	2		4							
18. Atmos. Temp. (°F/°C)	83		79							
19. Dew Point Temp. (°F/°C)	–		–							
20. Atmos. Pressure (in. Hg)	29.32		29.31							
21. Relative Humidity (%)	–		–							
22.										
23.										
24.	FGR									
25.	17% Plenum O_2									
26.	1% Stack O_2									
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/8-1

Test No. 1/8-1 Date 4-26-78 Location Engr. TIDONA

Unit No. Fuel N.G Capacity 6.5 × 10^6 Btu/h

Unit Type Research Furnace Burner Type DBA-16 (DBA TILE)
TIPS BACKWARDS

1. Test No.	1/8-1		1/8-1		1/8-1		1/8-1		1/8-1	
2. Date	4-26-78		4-26-78		4-26-78		4-26-78		4-26-78	
3. Time	12:10		13:30		14:00		14:20		14:55	
4. Load										
5. Process Rate BTU/hr	4.9 × 10^6		4.95 × 10^6		5.02 × 10^6		5.07 × 10^6		5.09 × 10^6	
6. Flue Diam. or Size, ft	8' × 6'		8 × 6'		6' × 6'		8' × 6'		8 × 6	
7. Probe Position	Center		Center		Center		Center		Center	
8. Oxygen (%)	3.7		3.1		2.8		2.85		2.7	
9. NOx (hot) read/3% O_2 (ppm)	50	52	54	59	54	53	56	55	51	50
10. NO (hot) read/3% O_2 (ppm)	48	50	53	53	53	52	55	54	50	49
11. NO_2 (hot) read/3% O_2 (ppm)	2	2	1	1	1	1	1	1	1	1
12. NO (cold) read/3% O_2 (ppm)	60	62	65	65	65	64	70	69	63	62
13. Carbon Dioxide (%)	9.9		10.2		10.2		10.2		10.2	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	79°		84°		81°		84°		85°	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.57		29.56		29.57		29.57		29.57	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1600		1680		1692°		1706°		1719°	
23.										
24.									O_2 INST. WOULDN'T	
25.									- SPAN REAL 44.7	
26.										
27.										
28.										
29.										
30.	BASELINE		BASELINE		BASELINE		BASELINE		BASELINE	

BAD DATA - LEAK IN SAMPLE LINE

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/8-2 to 5

Test No. 1/8-2 to 5 Date 4-26-78 Location ______ Engr. TIDONA

Unit No. ______ Fuel N.G. Capacity 6.5 x10⁶ Btu/h

Unit Type Research Furnace Burner Type DBA-16 (DBA Tile) TIPS BACKWARDS

1. Test No.	1/8-2		1/8-2		1/8-3		1/8-4		1/8-5	
2. Date	4-26-78		4-26		4-26		4-26		4-26	
3. Time	15:40		16:40		17:00		1720		17:40	
4. Load										
5. Process Rate Btu/h	5.12×10^6		5.12×10^6		5.24×10^6		5.22×10^6		5.19×10^6	
6. Flue Diam. or Size, ft	8'x6'		8'x6'		8'x6'		8'x6'		8'x6'	
7. Probe Position	Center		Center		Center		Center		Center	
8. Oxygen (%)	1.0		1.2		.3		4.5		3.1	
9. NOx (hot) read/3% O_2 (ppm)	45	41	48	44	14	12	0	/	0	/
10. NO (hot) read/3% O_2 (ppm)	44	40	48	44	13	11	0	/	0	/
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	0	0	1	1	0	/	0	/
12. NO (cold) read/3% O_2 (ppm)	58	52	60	55	55	48	53	56	55	55
13. Carbon Dioxide (%)	11.4		12.0		12.0		9.5		9.9	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	175	152	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	1	0	0
17. Smoke Spot (Bacharach)	0		2		2		0		0	
18. Atmos. Temp. (°F/°C)			80°F		80°		79°		77°	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.57		29.57		29.57		29.57		29.57	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1747°		1788°		1811°		1752		1763°	
23.										
24.					John Zink		John Zink			
25.					O_2 Reading		O_2 Read			
26.					KVB's Read					
27. BAD DATA LEAK IN SAMP LINE					.6-.7					
28.					something wrong		→			
29.					with hot line					
30.	1% O2		1% O_2		CO limit		HIGH O_2		[illegible] BASELINE	

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/8-6 to 9

Test No. 1/8-6 to 9 Date MAY 2 1978 Location ____ Engr. TIDONA

Unit No. ____ Fuel N.G. Capacity 6.5 x 10^6 Btu/h

Unit Type Research Furnace Burner Type DBA-16, PATTERN II

TIPS turned AROUND

1. Test No.	1/8-6		1/8-6		1/8-7		1/8-8		1/8-9	
2. Date	5-7-78		5-2-78		5-2-78		5-2-78		5-2-78	
3. Time	1725		1745		1805		1825		1850	
4. Load										
5. Process Rate Btu/hr.	5.09 x 10^6		5.10 x 10^6		5.07 x 10^6		5.03 x 10^6		5.07 x 10^6	
6. Flue Diam. or Size, ft	8' x 6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	3.0		2.8		0.5		1.1		4.05	
9. NOx (hot) read/3% O_2 (ppm)	69	69	65	64	58	51	66	60	78	83
10. NO (hot) read/3% O_2 (ppm)	68	68	65	64	56	49	65	59	77	82
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	0	0	2	2	1	1	1	1
12. NO (cold) read/3% O_2 (ppm)	85	85	83	82	80	70	85	77	88	93
13. Carbon Dioxide (%)	10.6		10.2		12.0		11.4		9.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	700	615	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
17. Smoke Spot (Bacharach)	0		0		0.5		0		0	
18. Atmos. Temp. (°F/°C)	73°F		70°F		79°F		83°F		83°F	
19. Dew Point Temp. (°F/°C)	—	—	—	—	—	—	—	—	—	—
20. Atmos. Pressure (in. Hg)	29.25		29.20		29.22		29.22		29.23	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB'S T/C	1733		1730		1773		1780		1755	
23.										
24.										
25.										
26.										
27.										
28.	Baseline		Baseline		O_2 SWING		O_2 SWING		O_2 Swing	
29.										
30.										

Data Sheet 6002-2

Test No. 1/8-10

MOBILE LABORATORY DATA

Test No. 1/8-10 **Date** MAY 2 1978 **Location**________ **Engr.**________

Unit No.________ **Fuel** Nat. Gas **Capacity** 6.5×10^6 Btu/h

Unit Type Research Furnace **Burner Type** DBA-16

1. Test No.	1/8-10									
2. Date	05-02-78									
3. Time	1910									
4. Load										
5. Process Rate BTU/hr.										
6. Flue Diam. or Size, ft	8' x 6'									
7. Probe Position	Center									
8. Oxygen (%)	3.0									
9. NOx (hot) read/3% O_2 (ppm)	73	73								
10. NO (hot) read/3% O_2 (ppm)	70	70								
11. NO_2 (hot) read/3% O_2 (ppm)	3	3								
12. NO (cold) read/3% O_2 (ppm)	90	90								
13. Carbon Dioxide (%)	10.6									
14. Carbon Monoxide (ppm) uncor/cor	0	0								
15. Hydrocarbon (ppm) uncor/cor	—	—								
16. Sulfur Dioxide (ppm) uncor/cor	—	—								
17. Smoke Spot (Bacharach)	0									
18. Atmos. Temp. (°F/°C)	85°F									
19. Dew Point Temp. (°F/°C)	—									
20. Atmos. Pressure (in. Hg)	29.22									
21. Relative Humidity (%)	—									
22. KVB T/C (°F)	1766									
23.										
24.										
25.										
26.										
27.										
28.	Baseline									
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/9-1 to 1/9-2

Test No. 1/9-1 to 1/9-2 Date APR 27 1978 Location ________ Engr. TiDONA

Unit No. ________ Fuel N.C. Capacity 6.5×10^6 BTU/Hr

Unit Type Research Furnace Burner Type DBA-16, PATTERN II TIPS NORMAL

1. Test No.	1/9-1		1/9-1		1/9-2		1/9-3		1/9-3	
2. Date	4-27-78		4-27-78		4-27-78					
3. Time	13:00		13:30		14:00		15:00		15:30	
4. Load										
5. Process Rate BTu/Hr	5.10×10^6		5.78×10^6		5.08×10^6		5.22×10^6		5.25×10^6	
6. Flue Diam. or Size, ft	8'x6'		—		—		—		→	
7. Probe Position	Center		—		—		—		→	
8. Oxygen (%)	3.05		3.2		3.1		2.7		3.0	
9. NOx (hot) read/3% O_2 (ppm)	115	115	115	116	97	98	91	90	93	93
10. NO (hot) read/3% O_2 (ppm)	113	113	115	116	95	96	90	89	93	93
11. NO_2 (hot) read/3% O_2 (ppm)	2	2	0	0	2	2	1	1	0	0
12. NO (cold) read/3% O_2 (ppm)	120	120	123	124	115	116	115	113	115	115
13. Carbon Dioxide (%)	9.9		10.2		10.2		10.6		10.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	82		83		88		85		81	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.52		29.43		29.41		29.39		29.38	
21. Relative Humidity (%)	—		—		—		—			
22. K.V.B's T/C (°F)	1703°		1722°		1731°		1749°		1759	
23.										
24.										
25.										
26.										
27.					Steam flow					
28.					~ 53 lb/hr		—		→	
29.										
30.	BASELINE		BASELINE		STEAM INJ THRU OIL TIP		STEAM INJ THRU OIL GUN		→	

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/9-4 to 6

Test No. 1/9-4 to 6 Date APR 27 78 Location ______ Engr. TIDONA

Unit No. ______ Fuel NG. Capacity ______

Unit Type Research Furnace Burner Type DBA -16, Pattern II Tips Normal

1. Test No.	1/9- 4		1/9- 5		1/9- 6					
2. Date	4-27-78		→							
3. Time	15:55		16:20		16:40					
4. Load										
5. Process Rate BTU/Hr	5.24 $\times 10^6$		5.28 $\times 10^6$		5.28 $\times 10^6$					
6. Flue Diam. or Size, ft	8x6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	3.0		3.0		3.0					
9. NOx (hot) read/3% O_2 (ppm)	93	93	86	86	108	108				
10. NO (hot) read/3% O_2 (ppm)	91	91	83	83	103	103				
11. NO_2 (hot) read/3% O_2 (ppm)	2	2	3	3	5	5				
12. NO (cold) read/3% O_2 (ppm)	115	115	110	110	130	130				
13. Carbon Dioxide (%)	10.6		10.6		10.3					
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0				
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
17. Smoke Spot (Bacharach)	—		—		—					
18. Atmos. Temp. (°F/°C)	80°		85°		86°					
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.36		29.36		29.35					
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB's T/C	1781		1774		1795°					
23.										
24.										
25.										
26.										
27.	Steam flow		Steam flow							
28.	= 53 lb/hr		= 75 lb/hr							
29.					Baseline					
30.	Steam inj New oil gun		Steam inj New oil gun		Repeat					

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/10-1to2

Test No. 1/10-1to2 Date APR 28 1978 Location_____ Engr._____

Unit No._____ Fuel_____ Capacity 6.5×10⁶ Btu/h

Unit Type Research Furnace Burner Type DBA-16

1. Test No.	1/10-1		1/10-1		1/10-1		1/10-2		1/10-2	
2. Date	4-28-78		4-28-78		4-28					
3. Time	11:10		12:00		12:25		14:45		1510	
4. Load										
5. Process Rate (Btu/h)	5.2×10⁶		5.06×10⁶		5.04×10⁶		5.23×10⁶		5.07×10⁶	
6. Flue Diam. or Size, ft	8'×6'		→		→		→		→	
7. Probe Position	Center		→		→		→		→	
8. Oxygen (%)	3.4		2.8		2.9		3.1		3.0	
9. NOx (hot) read/3% O_2 (ppm)	109	111	115	114	115	114	88	88	90	90
10. NO (hot) read/3% O_2 (ppm)	105	107	114	113	113	112	85	85	88	88
11. NO_2 (hot) read/3% O_2 (ppm)	4	4	1	1	2	2	3	3	2	2
12. NO (cold) read/3% O_2 (ppm)	133	136	148	146	146	145	111	112	113	113
13. Carbon Dioxide (%)	10.1		10.2		10.2		9.8		9.9	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	86°		86°		86°		96°		93°	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.34		29.30		29.30		29.25		29.25	
21. Relative Humidity (%)	—		—		—		—		—	
22. {U.B's T/C	1709°		1730°		1732°		1716°		1714°	
23.										
24.										
25.										
26.	BASELINE-						BASELINE-			
27.	STAGING CYL 3" ABOVE		→		→		STAGING CYL. 6" ABOVE		→	
28.	GAS TIPS						GAS TIPS			
29.										
30.										

Data Sheet 6002-2

Test No. 1/10-3

MOBILE LABORATORY DATA

Test No. 1/10-3 Date APR 28 1978 Location ________ Engr. TIDONA

Unit No. ________ Fuel N.G. Capacity 6.5×10^6 Btu/hr

Unit Type Research Furnace Burner Type DJA-16

1. Test No.	1/10-3		1/10-3				
2. Date	4/28/78		4/28/78				
3. Time	1630		1700				
4. Load							
5. Process Rate BTU/hr.	5.04×10^6		5.04×10^6				
6. Flue Diam. or Size, ft	8'×6'		→				
7. Probe Position	Center		→				
8. Oxygen (%)	3.1		3.3				
9. NOx (hot) read/3% O_2 (ppm)	75	75	78	79			
10. NO (hot) read/3% O_2 (ppm)	73	73	73	74			
11. NO_2 (hot) read/3% O_2 (ppm)	2	2	5	5			
12. NO (cold) read/3% O_2 (ppm)	90	91	95	97			
13. Carbon Dioxide (%)	9.9		9.9				
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0			
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—			
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0			
17. Smoke Spot (Bacharach)	0		0				
18. Atmos. Temp. (°F/°C)	90°		97				
19. Dew Point Temp. (°F/°C)	—		—				
20. Atmos. Pressure (in. Hg)	29.25		29.25				
21. Relative Humidity (%)	—		—				
22. K.V.B. T/C (°F)	1635		1660				
23.							
24.							
25.							
26.	BASELINE-						
27.	STAGING LVL		→				
28.	9" ABOVE						
29.	GAS TIPS						
30.							

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. ________

Test No. 1/10-4 to 5 Date MAY 1 1978 Location ________ Engr. TIDONA

Unit No. RES. FURN. Fuel NAT. GAS Capacity 6.5 x 10⁶ BTu/Hr

Unit Type ________ Burner Type DBA-16 - Pattern two Tips

1. Test No.	1/10-4		1/10-4		1/10-4		1/10-4		1/10-5	
2. Date	05-01-78		05-01-78		05-01-78		05-01-78		05-01-78	
3. Time	1105		1210		1320		1410		1600	
4. Load										
5. Process Rate Btu/hr.	5.15×10^6		5.14×10^6		5.11×10^6		5.1×10^6		5.57×10^6	
6. Flue Diam. or Size, ft	8'x6'		8x6'		8x6'		8x6'		8x6'	
7. Probe Position	CENTER		CENTER		CENTER		CENTER		CENTER	
8. Oxygen (%)	3.0		2.9		3.2		2.9		2.9	
9. NOx (hot) read/3% O_2 (ppm)	60	60	64	64	73	74	69	69	66	66
10. NO (hot) read/3% O_2 (ppm)	59	59	63	63	68	69	65	64	65	65
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	1	1	5	5	4	4	1	1
12. NO (cold) read/3% O_2 (ppm)	76	76	80	80	85	86	85	85	83	83
13. Carbon Dioxide (%)	10.1		10.6		10.1		10.1		10.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	79°F		82°F		83°F		80°F		70°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.14		29.15		29.18		29.19		29.20	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1522		1590		1645		1675		1669	
23.										
24.										
25.	BASELINE-		Baseline		Baseline		Baseline		Baseline	
26.	STAGING CYL.		Staging Cyl.		Staging Cyl.		Staging Cyl.		Staging Cyl.	
27.	37" ABOVE		37" above		37" above		37" above		43" above	
28.	GAS TIPS		Gas Tips.		Gas tips.		Gas tips.		Gas tips.	
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

MAY 1 1978

Test No. 1/10-5&8 Date________ Location________ Engr. TIDONA

Unit No. RES. FURN Fuel NAT. GAS Capacity 6.5×10^6 BTU/HR

Unit Type________ Burner Type DBA-16 - Pattern two Tips

1. Test No.	1/10-5		1/10-5		1/10-6		1/10-7		1/10-8	
2. Date	05-01-78		05-01-78		05-01-78		05-01-78		05-01-78	
3. Time	1630		1650		1705		1730		1755	
4. Load										
5. Process Rate BTU/hr	5.51×10^6		5.44×10^6		5.29×10^6		5.36×10^6		5.28×10^6	
6. Flue Diam. or Size, ft	8x6'		8x6'		8x6'		8x6'		8x6'	
7. Probe Position	CENTER		CENTER		CENTER		CENTER		CENTER	
8. Oxygen (%)	3.0		3.3		4.9		1.2		0.5	
9. NOx (hot) read/3% O_2 (ppm)	68	68	73	74	83	93	55	50	45	40
10. NO (hot) read/3% O_2 (ppm)	58	58	70	71	80	89	55	50	44	39
11. NO_2 (hot) read/3% O_2 (ppm)	10	10	3	3	3	3	0	0	1	1
12. NO (cold) read/3% O_2 (ppm)	88	88	90	92	98	110	73	66	58	51
13. Carbon Dioxide (%)	10.6		10.6		9.6		11.8		12.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	700	615
15. Hydrocarbon (ppm) uncor/cor	-	-	-	-	-	-	-	-	-	-
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	65°F		65°F		65°F		63°F		65°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.20		29.21		29.21		29.21		29.21	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1692		1702		1694		1724		1735	
23.										
24.										
25.	Baseline		Baseline		O_2 SWING		O_2 Swing		O_2 Swing	
26.	Staging Cyl.		Staging Cyl.		Staging Cyl.		Staging Cyl.		Staging Cyl.	
27.	43" above		43" above		43" above		43" above		43" above	
28.	Gas tips.		Gas tips.		gas tips		gas tips.		Gas tips.	
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/10-8 Date MAY 1 1978 Location________ Engr.________

Unit No. RES. FURN. Fuel NAT. GAS Capacity 6.5×10⁶ BTU/hr.

Unit Type________ Burner Type DBA-16- Pattern two tips

1. Test No.	1/10-8		1/10-9		1/10-9					
2. Date	05-01-78		05-01-78		05-01-78					
3. Time	1805		1825		1840					
4. Load										
5. Process Rate BTU/hr	5.25×10^6		5.33×10^6		5.29×10^6					
6. Flue Diam. or Size, ft	8×6'		8×6'		8×6'					
7. Probe Position	CENTER		CENTER		CENTER					
8. Oxygen (%)	0.5		2.9		3.2					
9. NOx (hot) read/3% O_2 (ppm)	46	40	66	66	70	71				
10. NO (hot) read/3% O_2 (ppm)	45	40	65	65	70	71				
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	1	1	0	0				
12. NO (cold) read/3% O_2 (ppm)	63	55	83	83	88	89				
13. Carbon Dioxide (%)	12.0		10.6		10.4					
14. Carbon Monoxide (ppm) uncor/cor	300	263	0	0	0	0				
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–				
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0				
17. Smoke Spot (Bacharach)	0		0		0					
18. Atmos. Temp. (°F/°C)	63°F		63°F		63°F					
19. Dew Point Temp. (°F/°C)	–		–		–					
20. Atmos. Pressure (in. Hg)	29.21		29.21		29.21					
21. Relative Humidity (%)	–		–		–					
22. KVB T/C (°F)	1747		1735		1742					
23.										
24.										
25.	O_2 Swing		O_2 Swing		O_2 Swing					
26.	Staging Cyl.		Staging Cyl.		Staging Cyl					
27.	43" above		43" above		43" above					
28.	gas tips.		gas tips.		gas tips					
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/11-1

Test No. 1/11-1 Date 02 May '78 Location ____ Engr. ____

Unit No. ____ Fuel Nat Gas Capacity 6.5 x 10^6 BTU/hr

Unit Type Research Furnace Burner Type DBA-16 - Pattern two

1. Test No.	1/11-1		1/11-1		1/11-1		1/11-1		1/11-1	
2. Date	05-02-78		05-02-78		05-02-78		5-2-78		5-2-78	
3. Time	0840		0900		0930		1000		1125	
4. Load										
5. Process Rate BTU/hr:	5.02 x 10^6		4.75 x 10^6		5.11 x 10^6		5.07 x 10^6		5.11 x 10^6	
6. Flue Diam. or Size, ft	6x8'		6x8'		6x8'		8'x6'		8'x6'	
7. Probe Position	Center		CENTER		Center		Center		Center	
8. Oxygen (%)	3.0		3.3		2.8		2.5		3.0	
9. NOx (hot) read/3% O_2 (ppm)	54	54	86	87	93	92	93	90	100	100
10. NO (hot) read/3% O_2 (ppm)	53	53	84	85	89	88	89	87	98	98
11. NO_2 (hot) read/3% O_2 (ppm)	1	1	2	2	4	4	4	3	2	2
12. NO (cold) read/3% O_2 (ppm)	68	68	105	107	111	110	112	109	120	120
13. Carbon Dioxide (%)	9.6		9.9		10.6		10.6		10.4	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	-	-	-	-	-	-	-	-	-	-
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	57°F		55°F		59°F		59°F		70°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.45		29.45		29.45		29.45		29.45	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1338		1405		1536		1532		1665	
23.										
24.	Heatup -		Heatup -		Heatup -		Heat up		Heat up	
25.	Baseline		Baseline		Baseline		Baseline		Baseline	
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MAY 2 1978

MOBILE LABORATORY DATA

Test No. 1/11-1 to 2

Test No. 1/11-1 to 2 Date______ Location______ Engr. TIDONA

Unit No.______ Fuel N.G. Capacity 6.5×10⁶ Btu/h

Unit Type Research Furnace Burner Type DBA-16, PATTERN II

1. Test No.	1/11-1		1/11-1		1/11-1		1/11-1		1/11-2	
2. Date	05-02-78		05-02-78		05-02-78		05-02-78		05-02-78	
3. Time	1155		1220		13.05		13:25		14:00	
4. Load										
5. Process Rate BTU/hr.	5.10×10^6		5.11×10^6		5.15×10^6		5.15×10^6		5.14×10^6	
6. Flue Diam. or Size, ft	8'×6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	3.1		3.0		3.0		3.1		1.1	
9. NOx (hot) read/3% O_2 (ppm)	98	99	99	99	75	75	78	78	93	84
10. NO (hot) read/3% O_2 (ppm)	95	96	98	98	73	73	77	77	90	81
11. NO_2 (hot) read/3% O_2 (ppm)	3	3	1	1	2	2	1	1	3	3
12. NO (cold) read/3% O_2 (ppm)	121	122	120	120	123	123	125	125	118	107
13. Carbon Dioxide (%)	10.4		10.6		10.2		9.9		11.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	70°F		71°F		71°F		72°		76°	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.45		29.45		29.45		29.45		29.45	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1682		1702		1731		1743		1786°	
23.										
24.	Heat-up		Heat up		Heat up		→		O_2 SWING	
25.	Baseline		Baseline		Baseline		→		1% O_2	
26.										
27.					←BAD HOT DATA→					
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/11-2to5

Test No. 1/11-2to5 Date MAY 2 1978 Location ______ Engr. TiDONA

Unit No. ______ Fuel N.G. Capacity 6.5 x10⁶ Btu/h

Unit Type Research Furnace Burner Type (DBA-16) Tips At NORMAL

1. Test No.	1/11-2		1/11-3		1/11-4		1/11-5			
2. Date	5-2-78		→							
3. Time	14:20		14:35		15:10		15:40			
4. Load										
5. Process Rate BTU/HR	5 07x10⁶		5.14x10⁶		4.88x10⁶					
6. Flue Diam. or Size, ft	8'x6'		→							
7. Probe Position	Center		→							
8. Oxygen (%)	1.05		4.5		0.3		3.0			
9. NOx (hot) read/3% O_2 (ppm)	95	86	108	118	86	75	113	113		
10. NO (hot) read/3% O_2 (ppm)	91	82	105	115	81	70	108	108		
11. NO_2 (hot) read/3% O_2 (ppm)	4	4	3	3	5	5	5	5		
12. NO (cold) read/3% O_2 (ppm)	124	112	130	142	111	97	135	135		
13. Carbon Dioxide (%)	11.2		9.5		12.0		10.6			
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	780	678				
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
17. Smoke Spot (Bacharach)	0		0		1					
18. Atmos. Temp. (°F/°C)	76°		72°		79°		80°			
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.45		29.45		29.40		29.40			
21. Relative Humidity (%)	—		—		—		—		—	
22. K.V.B's T/C	1786°		1776°		1785°		1789°			
23.										
24.										
25.										
26.										
27.										
28.										
29.							Repeat			
30.							Baseline			

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/12-1 to 3

Test No. 1/12-1 to 3 Date MAY 3 1978 Location ______ Engr. TIDONA

Unit No. ______ Fuel N. G. Capacity 6.5 × 10⁶ Btu/h

Unit Type Research Furnace Burner Type TERTIARY AIR - WITH MODIFIED SECONDARY TILE

1. Test No.	1/12-1		1/12-1		1/12-1		1/12-2		1/12-3	
2. Date	05·03·78		05·03·78		05-03-78		05·03·78		05·03·78	
3. Time	1330		1405		1525		1615		1635	
4. Load										
5. Process Rate BTU/hr	5.20×10^6		5.25×10^6		5.33×10^6		5.23×10^6		5.29×10^6	
6. Flue Diam. or Size, ft	8×6		8×6		8×6		8×6		8×6	
7. Probe Position	Center		Center		Center		Center		Center	
8. Oxygen (%)	3.0		3.0		3.0		1.3		0.5	
9. NOx (hot) read/3% O_2 (ppm)	75	75	78	78	84	84	81	74	75	66
10. NO (hot) read/3% O_2 (ppm)	73	73	73	73	80	80	78	71	70	61
11. NO_2 (hot) read/3% O_2 (ppm)	2	2	5	5	4	4	3	3	5	4
12. NO (cold) read/3% O_2 (ppm)	94	94	95	95	100	100	95	87	93	82
13. Carbon Dioxide (%)	10.6		10.6		10.6		11.5		11.7	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	220	193
15. Hydrocarbon (ppm) uncor/cor	-	-	-	-	-	-	-	-	-	-
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	0		0		0		0		0	
18. Atmos. Temp. (°F/°C)	64°F		59°F		61°F		63°F		63°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.11		29.11		29.10		29.10		29.10	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1682		1724		1778		1812		1840	
23.										
24.										
25.	Baseline		Baseline		Baseline		O_2 swing		O_2 swing	
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

Test No. 1/12-4 to 5

MOBILE LABORATORY DATA

Test No. 1/12-4 to 5 Date MAY 3 1978 Location ______ Engr. TIDONA

Unit No. ______ Fuel Nat. Gas Capacity 6.5 x 10⁶ Btu/h

Unit Type Research Furnace Burner Type Tertiary Air - with modified secondary tile

1. Test No.	1/12-4		1/12-4		1/12-5					
2. Date	05-03-78		05-03-78		05-03-78					
3. Time	17:25		17:35		17:50					
4. Load										
5. Process Rate BTU/hr	5.18×10^6		5.22×10^6		5.18×10^6					
6. Flue Diam. or Size, ft	8x6		8x6		8'x6'					
7. Probe Position	Center		Center		Center					
8. Oxygen (%)	3.0		3.0		4.2					
9. NOx (hot) read/3% O_2 (ppm)	86	86	83	83	85	91				
10. NO (hot) read/3% O_2 (ppm)	83	83	81	81	83	89				
11. NO_2 (hot) read/3% O_2 (ppm)	3	3	2	2	2	2				
12. NO (cold) read/3% O_2 (ppm)	110	110	105	105	104	111				
13. Carbon Dioxide (%)	10.2		10.2		9.9					
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0				
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—				
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0				
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	63 °F		63°		67°					
19. Dew Point Temp. (°F/°C)	—		—		—					
20. Atmos. Pressure (in. Hg)	29.05		29.05		29.06					
21. Relative Humidity (%)	—		—		—					
22. KVB T/C (°F)	1830°		1831°		1830°					
23.										
24.										
25.										
26.	O_2 swing		O_2 Swing		O_2 Swing					
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/12-6 Date MAY 4 1978 Location________ Engr. Tidona

Unit No.________ Fuel #6 Oil Capacity 6.5×10^6 Btu/h

Unit Type Research Furnace Burner Type Tertiary Air - with modified secondary tile

Tip 784

1. Test No.	1/12-6		1/12-6		1/12-6		1/12-6		1/12-6	
2. Date	05.04.78		05.04.78		05.04.78		05.04.78		05.04.78	
3. Time	1225		1320		1430		1500		1520	
4. Load										
5. Process Rate BTU/hr	$\sim5\times10^6$		$\sim5\times10^6$		$\sim5\times10^6$		-5×10^6		$\sim5\times10^6$	
6. Flue Diam. or Size, ft	8x6'		8x6'		8x6'		8x6'		8x6'	
7. Probe Position	Center		Center		Center		Center		Center	
8. Oxygen (%)	2.9		3.0		3.2		2.9		3.0	
9. NOx (hot) read/3% O_2 (ppm)	200	199	188	188	205	207	210	209	208	208
10. NO (hot) read/3% O_2 (ppm)	190	189	170	170	200	202	205	204	205	205
11. NO_2 (hot) read/3% O_2 (ppm)	10	10	18	18	5	5	5	5	3	3
12. NO (cold) read/3% O_2 (ppm)	225	224	220	220	230	233	235	234	235	235
13. Carbon Dioxide (%)	12.0P.		13.6		13.6		14.0		13.6	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	—	—	—	—	—	—	—	—	—	—
16. Sulfur Dioxide (ppm) uncor/cor	920	915	905	905	830	839	1060	1054	1090	1090
17. Smoke Spot (Bacharach)	1		1		1		1		1	
18. Atmos. Temp. (°F/°C)	64°F		67°F		76°F		82°F		71°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	29.02		29.02		29.02		29.02		29.02	
21. Relative Humidity (%)	—		—		—		—		—	
22. KVB T/C (°F)	1762		1778		1834		1842		1851	
23.										
24.										
25.	Baseline		Baseline		Baseline		Baseline		Baseline	
26.										
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 1/12-6 to 10 Date MAY 4 1978 Location________ Engr. TIDONA

Unit No.________ Fuel #6 OIL Capacity 6.5 x 10⁶ BTU/hr

Unit Type Research Furnace Burner Type Tertiary Air - with modified secondary tile Tip 784

1. Test No.	1/12-7		1/12-8		1/12-8		1/12-9		1/12-10	
2. Date	05.04.78		05.04.78		05.04.78		05.04.78		05.04.78	
3. Time	1540		1605		1625		1655		1720	
4. Load										
5. Process Rate BTU/hr.	~5x10⁶		~5x10⁶		~5x10⁶		~5x10⁶		~5x10⁶	
6. Flue Diam. or Size, ft	8x6'		8x6'		8x6'		8x6'		8x6'	
7. Probe Position	Center		Center		Center		Center		Center	
8. Oxygen (%)	0.8		0.2		0.2		3.1		4.35	
9. NOx (hot) read/3% O_2 (ppm)	185	165	170	147	140	121	205	206	170	184
10. NO (hot) read/3% O_2 (ppm)	185	165	165	143	130	113	200	201	165	178
11. NO_2 (hot) read/3% O_2 (ppm)	0	0	5	4	10	9	5	5	5	6
12. NO (cold) read/3% O_2 (ppm)	225	200	180	156	180	156	230	231	220	238
13. Carbon Dioxide (%)	14.7		15.2		(?) 13.6		13.6		13.2	
14. Carbon Monoxide (ppm) uncor/cor	0	0	340	294	340	294	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	–	–	–	–	–	–	–	–	–	–
16. Sulfur Dioxide (ppm) uncor/cor	1040	927	1540	1333	1160	1004	840	845	960	1038
17. Smoke Spot (Bacharach)	1		2		2		1		0.5	
18. Atmos. Temp. (°F/°C)	75°F		76°F		80°F		80°F		75°F	
19. Dew Point Temp. (°F/°C)	–		–		–		–		–	
20. Atmos. Pressure (in. Hg)	29.02		29.02		29.02		29.02		29.02	
21. Relative Humidity (%)	–		–		–		–		–	
22. KVB T/C (°F)	1866		1872		1870		1872		1867	
23.										
24.										
25.										
26.	O_2 swing		O_2 Swing		O_2 swing		O_2 swing		O_2 swing	
27.										
28.										
29.										
30.										

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 1/12-10

MAY 4 1978

Test No. 1/12-10 Date ____ Location ____ Engr. TIDONA

Unit No. ____ Fuel NO.6 OIL Capacity 6.5x10⁶ Btu/h

Unit Type RES. FURN. Burner Type TERTIARY AIR - MODIFIED SEC. TILE TIP784

1. Test No.	1/12-10					
2. Date	05.04.78					
3. Time	1730					
4. Load						
5. Process Rate Btu/hr.	~5×10^6					
6. Flue Diam. or Size, ft	8x6'					
7. Probe Position	Center					
8. Oxygen (%)	4.1					
9. NOx (hot) read/3% O_2 (ppm)	200	213				
10. NO (hot) read/3% O_2 (ppm)	195	208				
11. NO_2 (hot) read/3% O_2 (ppm)	5	5				
12. NO (cold) read/3% O_2 (ppm)	225	240				
13. Carbon Dioxide (%)	13.2					
14. Carbon Monoxide (ppm) uncor/cor	0	0				
15. Hydrocarbon (ppm) uncor/cor	–	–				
16. Sulfur Dioxide (ppm) uncor/cor	840	895				
17. Smoke Spot (Bacharach)	1/2					
18. Atmos. Temp. (°F/°C)	75°F					
19. Dew Point Temp. (°F/°C)	—					
20. Atmos. Pressure (in. Hg)	29.02					
21. Relative Humidity (%)	—					
22. KVB T/C (°F)	1854					
23.						
24.						
25.	O2 Swing					
26.						
27.						
28.						
29.						
30.						

Data Sheet 6002-2

KVB

TEST BURNER DATA SHEET

Test Date Jan 12, 1978 Type Burner MA-16 Comb. Test Run #

Burner Gas Tip Sizing

Test No.					
Time	10:20	11:10			
GAS FIRING					
Burner Gas Pressure (psig)	—	—			
Gas Meter Flow (cfm)	22.4	22.4			
Meter Pressure (psig)	45	45			
Meter Correction Factor	4.07	4.07			
Heat Release on Gas (MMBtu/hr)	5.08	5.08			
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.19	-0.18			
Windbox Pressure	0	0			
O_2	3.2	3.3			
Combustibles	0	0			
Primary Air Door Opening	FULL OPEN	FULL OPEN			
Secondary Air Door Opening	FULL OPEN	FULL OPEN			
TEMPERATURE READINGS, °F					
T/C-2	1375	1479			
T/C-3	1401	1483			
T/C-4	1297	1397			
T/C-5	1274	1374			
T/C-6	1251	1337			
T/C-7	1433	1509			
T/C-8	1379	1439			
T/C-9	1228	1318			
T/C-10	1267	1347			
T/C-11	1386	1450			
T/C-12	1457	1514			

Flame Length

Flame Width

Flame Characteristic

COMMENTS: O_2 Traverse. Traverse showed an O_2 range from 3.15% to 3.4%

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN. 12, 1978 Type Burner MA-16 Test Run #

Burner Gas Tip Sizing

Test No.	1/1-1				→
Time	1515	1545	1615	1645	1715
GAS FIRING					
Burner Gas Pressure (psig)	12.9				→
Gas Meter Flow (cfm)	22.4				→
Meter Pressure (psig)	45				→
Meter Correction Factor	4.07				→
Heat Release on Gas (MMBtu/hr)	5.08				→
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.7				→
Windbox Pressure	0				
O_2	2.8	3.1	2.8	3.0	3.2
Combustibles	0				→
Primary Air Door Opening	FULL OPEN				→
Secondary Air Door Opening	FULL OPEN				→
TEMPERATURE READINGS, °F					
T/C-2	1666	1671	1676	1682	1687
T/C-3	1619	1620	1628	1635	1643
T/C-4	1588	1594	1603	1609	1616
T/C-5	1568	1576	1581	1588	1593
T/C-6	1501	1510	1525	1540	1550
T/C-7	1659	1660	1667	1674	1679
T/C-8	1579	1586	1599	1609	1616
T/C-9	1497	1506	1516	1525	1532
T/C-10	1521	1523	1533	1541	1549
T/C-11	1584	1584	1595	1601	1608
T/C-12	1629	1631	1643	1648	1655

Flame Length

Flame Width

Flame Characteristic

COMMENTS: Baseline test, conventional burner

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 13, 1978 Type Burner MA-16 Test Run # ____

Burner Gas Tip Sizing Pattern II

Test No.	1/1-2	1/1-2	1/1-3	1/1-4	1/1-5
Time	9:10	10:25	10:45	11:45	1310
GAS FIRING					
Burner Gas Pressure (psig)	12.9	13.2	13.6	12.4	12.8
Gas Meter Flow (cfm)	22.4	→	→	→	→
Meter Pressure (psig)	45	→	→	→	→
Meter Correction Factor	4.07	→	→	→	→
Heat Release on Gas (MMBtu/hr)	5.08	→	→	→	→
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.17	-0.18	-0.175	-0.15	-0.15
Windbox Pressure	—	—	—	—	—
O_2	2.9	3.8	3.1	2.6	1.1
Combustibles	0	0	0	0	0
Primary Air Door Opening	100% OPEN	100% OPEN	→	→	→
Secondary Air Door Opening	100% OPEN	100% OPEN	→	→	→
TEMPERATURE READINGS, °F					
T/C-2	1438	1535	1559	1618	1675
T/C-3	1446	1516	1530	1598	1660
T/C-4	1368	1456	1480	1537	1594
T/C-5	1339	1433	1457	1518	1575
T/C-6	1312	1384	1399	1459	1517
T/C-7	1494	1562	1586	1624	1673
T/C-8	1428	1477	1498	1536	1594
T/C-9	1302	1382	1403	1454	1505
T/C-10	1329	1404	1426	1475	1525
T/C-11	1435	1490	1510	1548	1592
T/C-12	1501	1547	1567	1596	1640

Flame Length ____

Flame Width ____

Flame Characteristic ____

COMMENTS: Conventional burner

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN. 13, 1978 Type Burner MA - 16 Test Run # _____

Burner Gas Tip Sizing Pattern II

Test No.	1/1-6	1/1-7	1/1-8		
Time	1345	1515	1525		
GAS FIRING					
Burner Gas Pressure (psig)	13.4	13.0	13.4		
Gas Meter Flow (cfm)	22.4	→			
Meter Pressure (psig)	45	→			
Meter Correction Factor	4.07	→			
Heat Release on Gas (MMBtu/hr)	5.08	→			
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.14	-0.18	-0.18		
Windbox Pressure	–	–	–		
O_2	0.9	3.7	3.1		
Combustibles	0	0	0		
Primary Air Door Opening	100% OPEN	→			
Secondary Air Door Opening	100% OPEN	→			
TEMPERATURE READINGS, °F					
T/C-2	1693	1704	1705		
T/C-3	1677	1639	1632		
T/C-4	1616	1628	1629		
T/C-5	1592	1607	1608		
T/C-6	1530	1559	1557		
T/C-7	1696	1693	1699		
T/C-8	1618	1632	1635		
T/C-9	1524	1546	1549		
T/C-10	1548	1566	1570		
T/C-11	1611	1627	1630		
T/C-12	1662	1669	1674		

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 16, 1978 Type Burner MA - 16 Test Run #

Burner Gas Tip Sizing MA-16 Pattern II

Test No.	1/1 - 9	→			→
Time	1000	1040	1105	1145	1220
GAS FIRING					
Burner Gas Pressure (psig)	12.8	13.2	13.5	13.2	13.0
Gas Meter Flow (cfm)	22.4	→			→
Meter Pressure (psig)	45	→			→
Meter Correction Factor	4.07	→			→
Heat Release on Gas (MMBtu/hr)	5.08	→			→
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.16	-0.17	-0.17	-0.17	-0.18
Windbox Pressure	-	-	-	-	-
O_2	4.1	3.3	3.6	3.7	4.6
Combustibles	0	0	0	0	0
Primary Air Door Opening	100% OPEN	→			→
Secondary Air Door Opening	100% OPEN	→			→
TEMPERATURE READINGS, °F					
T/C-2	1427	1495	1532	1568	1596
T/C-3	1430	1506	1541	1574	1593
T/C-4	1366	1434	1471	1505	1534
T/C-5	1349	1421	1461	1498	1533
T/C-6	1303	1369	1405	1434	1463
T/C-7	1452	1515	1553	1579	1608
T/C-8	1356	1415	1445	1470	1492
T/C-9	1240	1301	1335	1364	1392
T/C-10	1276	1340	1375	1407	1436
T/C-11	1395	1448	1476	1500	1521
T/C-12	1450	1499	1527	1547	1567

Flame Length

Flame Width

Flame Characteristic

COMMENTS: Baseline measurements

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 16, 1978 Type Burner MA - 16 Test Run # _____

Burner Gas Tip Sizing MA -16 PATTERN II - MODIFIED

Test No.	1/1-10	—	—	—	→
Time	1335	1410	1435	1500	1535
GAS FIRING					
Burner Gas Pressure (psig)	12.9	12.9	12.9	12.8	13.2
Gas Meter Flow (cfm)	22.4	—	—	—	→
Meter Pressure (psig)	45	—	—	—	→
Meter Correction Factor	4.07	—	—	—	→
Heat Release on Gas (MMBtu/hr)	5.08	—	—	—	→
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.18	-0.17	-0.16	-0.18	-0.18
Windbox Pressure	–	–	–	–	–
O_2	6.0	—	—	—	→
Combustibles	0	—	—	—	→
Primary Air Door Opening	100% OPEN	—	—	—	→
Secondary Air Door Opening	100% OPEN	—	—	—	→
TEMPERATURE READINGS, °F					
T/C-2	1608	1633	1650	1660	1673
T/C-3	1550	1567	1579	1587	1594
T/C-4	1511	1531	1547	1557	1573
T/C-5	1510	1528	1541	1550	1561
T/C-6	1479	1507	1527	1537	1550
T/C-7	1601	1620	1632	1639	1651
T/C-8	1525	1550	1565	1574	1588
T/C-9	1410	1435	1451	1462	1476
T/C-10	1454	1478	1493	1504	1518
T/C-11	1557	1579	1595	1604	1617
T/C-12	1605	1623	1637	1645	1658

Flame Length

Flame Width

Flame Characteristic

COMMENTS: Baseline Test

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN. 17, 1978 **Type Burner** MA-16 **Test Run #**

Burner ~~Gas Tip Sizing~~ OIL GUN TIP 764

Test No.	1/1-11	→			
Time	1305	1335	1410	1445	1545
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	74.8	76.0	75.0	75.0	74.4
Burner Steam Pressure (psig)	102	109	106	107	105
Oil Flow (gpm)	.566	.548	.571	.544	.574
Steam Flow (lb/hr)	-	-	-	-	-
Type Oil	#6	→			
Oil Temperature	256	256	256	254	255
Heat Release on Oil (MMBtu/hr)	4.75	4.60	4.79	4.56	4.82
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.08	→			
Windbox Pressure	-	-	-	-	-
O_2	2.8	2.9	3.5	—	3.0
Combustibles	0	0	0	0	0
Primary Air Door Opening	100% OPEN	→			
Secondary Air Door Opening	100% OPEN	→			
TEMPERATURE READINGS, °F					
T/C-2	1405	1468	1500	1529	1582
T/C-3	1440	1514	1548	1574	1621
T/C-4	1325	1384	1420	1450	1574
T/C-5	1333	1389	1424	1454	1507
T/C-6	1290	1340	1370	1399	1449
T/C-7	1446	1492	1512	1542	1564
T/C-8	1360	1404	1428	1452	1494
T/C-9	1247	1295	1324	1348	1398
T/C-10	1288	1330	1359	1383	1430
T/C-11	1391	1434	1458	1480	1517
T/C-12	1447	1487	1509	1528	1563
Flame Length	28"x6'	→			
Flame Width					
Flame Characteristic					

COMMENTS: Baseline Measurements

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 18, 1978 Type Burner MA-16 Test Run #

Burner ~~Gas Tip Sizing~~ OIL NOZZLE TIP 764

Test No.	1/1-12	1/1-12	1/1-13	1/1-14	1/1-15
Time	0940	1010	1040	1110	1140
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	74.2	75.0	75.0	75.0	75.0
Burner Steam Pressure (psig)	105	104	104	105.5	107
Oil Flow (gpm)	.543	.593	.559	.546	.563
Steam Flow (lb/hr)	–				
Type Oil	#6	→			
Oil Temperature	255	255	255	256	256
Heat Release on Oil (MMBtu/hr)	4.56	4.98	4.69	4.58	4.72
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.08	-0.07	-0.06	-.05	-.03
Windbox Pressure	–	–	–	–	–
O_2	3.3	–	1.8	1.0	0.1
Combustibles	0	–	0	0	1.0
Primary Air Door Opening	100% OPEN	→			
Secondary Air Door Opening	100% OPEN	→			
TEMPERATURE READINGS, °F					
T/C-2	1329	1391	1435	1494	1525
T/C-3	1396	1460	1499	1550	1577
T/C-4	1247	1304	1346	1405	1438
T/C-5	1238	1297	1342	1397	1431
T/C-6	1210	1267	1307	1353	1382
T/C-7	1371	1424	1456	1506	1527
T/C-8	1293	1348	1381	1427	1445
T/C-9	1178	1229	1265	1309	1337
T/C-10	1208	1259	1295	1340	1365
T/C-11	1333	1380	1410	1447	1468
T/C-12	1395	1437	1464	1500	1513
Flame Length	6'	→			8'
Flame Width	32"	→			48"
Flame Characteristic					Lazy Flame

COMMENTS: O2 Swing

KVB

TEST BURNER DATA SHEET

Test Date JAN 18, 1978 Type Burner MA - 16 Test Run #

Burner Gas Tip Sizing OIL NOZZLE TIP 764

Test No.	1/1-16	1/1-17			
Time	1220	1245			
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	74.0	75.0			
Burner Steam Pressure (psig)	102	105.5			
Oil Flow (gpm)	.557	.567			
Steam Flow (lb/hr)	-				
Type Oil	#6	#6			
Oil Temperature	256	255			
Heat Release on Oil (MMBtu/hr)	4.67	4.76			
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.08	-0.03			
Windbox Pressure	-	-			
O_2	4.0	0.25			
Combustibles	0	0			
Primary Air Door Opening	100% OPEN	100% OPEN			
Secondary Air Door Opening	100% OPEN	100% OPEN			
TEMPERATURE READINGS, °F					
T/C-2	1554	1577			
T/C-3	1597	1614			
T/C-4	1475	1501			
T/C-5	1468	1492			
T/C-6	1417	1437			
T/C-7	1547	1569			
T/C-8	1463	1481			
T/C-9	1368	1386			
T/C-10	1396	1413			
T/C-11	1488	1503			
T/C-12	1535	1548			
Flame Length	6'	8'			
Flame Width	32"	48"			
Flame Characteristic		Lazy Flame			

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 18, 78 Type Burner MA - 16 Test Run #

Burner ~~Gas Tip Sizing~~ OIL TIP # 763

Test No.	1/1- 18	→	→	→	→
Time	1350	1420	1500	1530	1555
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75.0	75.0	75.4	75.0	75.0
Burner Steam Pressure (psig)	106	105	106.5	107	104
Oil Flow (gpm)	.548	.542	.569	.552	.552
Steam Flow (lb/hr)	-	-	-	-	-
Type Oil	#6	→	→	→	→
Oil Temperature	257	255	250	248	248
Heat Release on Oil (MMBtu/hr)	4.60	4.55	4.77	4.63	4.63
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.07	→	→	→	→
Windbox Pressure	-	-	-	-	-
O_2	3.0	3.2	3.2	3.1	3.0
Combustibles	-	-	-	-	-
Primary Air Door Opening	100% OPEN	→	→	→	→
Secondary Air Door Opening	100% OPEN	→	→	→	→
TEMPERATURE READINGS, °F					
T/C-2	1581	1597	1613	1623	1625
T/C-3	1605	1623	1641	1651	1651
T/C-4	1516	1532	1553	1565	1566
T/C-5	1512	1528	1547	1559	1562
T/C-6	1457	1479	1498	1510	1513
T/C-7	1586	1601	1619	1624	1621
T/C-8	1499	1518	1535	1544	1544
T/C-9	1410	1427	1445	1457	1462
T/C-10	1435	1452	1472	1482	1484
T/C-11	1515	1530	1547	1555	1555
T/C-12	1561	1575	1592	1598	1595
Flame Length	9-10'	→	→	→	→
Flame Width	26"	→	→	→	→
Flame Characteristic					

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 19, 1978 Type Burner MA - 16 Test Run # ____

Burner ~~Gas Tip Sizing~~ OIL TIP # 765

Test No.	1/1- 19	1/1-19			
Time	0905	0935			
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75.0	75.6			
Burner Steam Pressure (psig)	107	106			
Oil Flow (gpm)	.583	1578			
Steam Flow (lb/hr)	–	–			
Type Oil	#6 →	→			
Oil Temperature	250	250			
Heat Release on Oil (MMBtu/hr)	4.89	4.85			
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.15	-0.15			
Windbox Pressure	–	–			
O_2	2.4-45	3.7- 4.2			
Combustibles	–	–			
Primary Air Door Opening	100% OPEN →	→			
Secondary Air Door Opening	100% OPEN →	→			
TEMPERATURE READINGS, °F					
T/C-2	1247	1322			
T/C-3	1253	1348			
T/C-4	1155	1222			
T/C-5	1156	1227			
T/C-6	1140	1200			
T/C-7	1313	1365			
T/C-8	1220	1266			
T/C-9	1104	1153			
T/C-10	1137	1190			
T/C-11	1259	1296			
T/C-12	1327	1352			
Flame Length	6'	5'			
Flame Width	48"	36"			
Flame Characteristic	Flame impinging on Tile	Sparks			

COMMENTS:

BASELINE TEST

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 19, 1978 Type Burner MA - 16 Test Run #

Burner ~~Gas Tip Sizing~~ Oil Tip # 763

Test No.	1/1-20	1/1-21	1/1-22	1/1-23	1/1-24
Time	1100	1135	1200	1225	1245
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75.0	75.0	75.0	75.5	75.0
Burner Steam Pressure (psig)	105	109	108	107	107
Oil Flow (gpm)	.551	.595	.584	.563	.589
Steam Flow (lb/hr)	–	–	–	–	–
Type Oil	#6	→			
Oil Temperature	250	250	250	251	252
Heat Release on Oil (MMBtu/hr)	4.62	4.99	4.90	4.72	4.94
AIR INFORMATION					
Furnace Draft (in. H_2O)	-.08	-.08	-.07	-.07	-0.10
Windbox Pressure	–	–	–	–	–
O_2	–	–	–	–	–
Combustibles	–	–	–	–	–
Primary Air Door Opening	100% OPEN	→			
Secondary Air Door Opening	100% OPEN	→			
TEMPERATURE READINGS, °F					
T/C-2	1411	1466	1504	1535	1547
T/C-3	1322	1499	1539	1573	1582
T/C-4	1323	1365	1403	1432	1444
T/C-5	1347	1393	1425	1457	1472
T/C-6	1303	1359	1389	1422	1437
T/C-7	1461	1496	1533	1557	1562
T/C-8	1371	1416	1448	1473	1480
T/C-9	1249	1294	1319	1348	1362
T/C-10	1293	1336	1363	1390	1402
T/C-11	1389	1433	1460	1484	1493
T/C-12	1447	1486	1512	1533	1541
Flame Length	9'	→			
Flame Width	26"	→			
Flame Characteristic	Long, Thin	→			

COMMENTS: Base line of O_2 swing

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date JAN 20, 1978 Type Burner MA-16 Test Run #_____

Burner ~~Gas Tip Sizing~~ Oil Tip # 764

Test No.	1/1-25	→			→
Time	1125	1200	1225	1305	1320
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	42	41	41	41	42
Burner Steam Pressure (psig)	68	64.5	65	64	69
Oil Flow (gpm)	.580	.587	.592	.594	.594
Steam Flow (lb/hr)	–	-	-	-	-
Type Oil	#2	→			→
Oil Temperature (°F)	25	25	25	25	25
Heat Release on Oil (MMBtu/hr)	4.73	4.79	4.83	4.85	4.85
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.16	-0.16	-0.15	-0.15	-0.15
Windbox Pressure	–	-	–	-	–
O_2	3.5	3.4	–	–	–
Combustibles	–	-	–	-	-
Primary Air Door Opening	30% OPEN	→		100% OPEN	→
Secondary Air Door Opening	100% OPEN	→			→
TEMPERATURE READINGS, °F					
T/C-2	958	1081	1172	1293	1328
T/C-3	902	1087	1219	1368	1407
T/C-4	925	1032	1112	1218	1252
T/C-5	888	999	1087	1196	1231
T/C-6	875	979	1067	1181	1217
T/C-7	1095	1185	1264	1347	1375
T/C-8	920	1033	1132	1253	1284
T/C-9	856	955	1040	1135	1163
T/C-10	899	993	1073	1167	1198
T/C-11	997	1100	1187	1289	1317
T/C-12	1118	1199	1274	1353	1375
Flame Length	> 6'				~ 10'
Flame Width	36"				48"
Flame Characteristic					

COMMENTS: Baseline tests with No. 2 oil

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 13, 1978 Type Burner RECIRC. TILE (DBA-16, LO-NO_x) Test Run # 1/2-1 to 2

Burner Gas Tip Sizing PATTERN III GAS TIPS

Test No.	1/2-1	1/2-1	1/2-1	1/2-1	1/2-2
Time	1510	1545	1620	1645	1730
GAS FIRING					
Burner Gas Pressure (psig)	16.7	16.9	16.1	16.4	16.1
Gas Meter Flow (cfm)	—	—	20.62	20.91	20.91
Meter Pressure (psig)	—	—	46.6	46.6	46.5
Meter Correction Factor	—	—	4.18	4.18	4.175
Heat Release on Gas (MMBtu/hr)	—	—	4.81	4.88	4.87
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.10	-0.11	-0.10	-0.08
Windbox Pressure	—	—	—	—	—
O_2 (%)	2.5	—	4.1	3.6	3.6
Combustibles	0	—	0	0	0
Primary Air Door Opening	100% OPEN	→	→	→	→
Secondary Air Door Opening	100% OPEN	→	→	→	→
TEMPERATURE READINGS, °F					
T/C-2	1219	1295	1369.	1410	1477
T/C-3	1294	1368	1431	1464	1514
T/C-4	1108	1178	1241	1274	1323
T/C-5	1051	1135	1220	1268	1346
T/C-6	1024	1104	1189	1236	1320
T/C-7	1214	1288	1357	1398	1458
T/C-8	1170	1251	1318	1353	1409
T/C-9	1010	1080	1151	1189	1251
T/C-10	1043	1120	1193	1233	1298
T/C-11	1191	1253	1317	1350	1406
(Stack) T/C-12	1269	1314	1364	1395	1455
Flame Length	6-7 feet		GAS TIPS FLUSH WITH TOP OF PIECE "A" OF TILE		↑ GAS TIPS ½" BELOW TOP OF PIECE "A"
Flame Width	~3' diam				
Flame Characteristic	blue, hot tile Some yellow areas where flow is recirculating			flame less visible	flame is ~ same
COMMENTS:	BASELINE	BASELINE	BASELINE	BASELINE	BASELINE

KVB

TEST BURNER DATA SHEET

Test Date FEB. 13, 1978 **Type Burner** RECIRC. TILE **Test Run #** 1/2-2

Burner ~~Gas~~ Tip Sizing PATTERN III

Test No.	1/2-2				
Time	1800				
GAS FIRING					
Burner Gas Pressure (psig)	16.0				
Gas Meter Flow (cfm)	20.91				
Meter Pressure (psig)	46.4				
Meter Correction Factor	4.16				
Heat Release on Gas (MMBtu/hr)	4.85				
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.09				
Windbox Pressure	—				
O_2 (%)	4.1				
Combustibles	0				
Primary Air Door Opening	100% OPEN				
Secondary Air Door Opening	100% OPEN				
TEMPERATURE READINGS, °F					
T/C-2	1505				
T/C-3	1528				
T/C-4	1342				
T/C-5	1378				
T/C-6	1352				
T/C-7	1485				
T/C-8	1434				
T/C-9	1280				
T/C-10	1332				
T/C-11	1435				
T/C-12	1480				
Flame Length	GAS TIPS ½" BELOW TOP OF				
Flame Width	PIECE "A"				
Flame Characteristic	OF TILE				

COMMENTS:

BASELINE

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 14, 1978 **Type Burner** RECIRC. TILE (DBA-16, LO-NOx) **Test Run #** 1/2-3

Burner ~~Gas~~ Oil **Tip Sizing** TIP 766

Test No.	1/2-3				→
Time	1215	1245	1315	1345	1415
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	71.0	71.0	70.0	70.0	70.0
Burner Steam Pressure (psig)	92.0	91.0	89.0	90.0	90.0
Oil Flow (gpm)	0.674	0.667	0.671	0.692	0.690
Steam Flow (lb/hr)					
Type Oil	#2				→
Oil Temperature	58	58	59	60	60
Heat Release on Oil (MMBtu/hr)	5.08	5.03	5.06	5.21	5.20
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.11				→
Windbox Pressure					
O_2 (%)	3.5	6.3	5.0	7.6	5.4
Combustibles	0	0	0	0	0
Primary Air Door Opening	100% OPEN				→
Secondary Air Door Opening	100% OPEN				→
TEMPERATURE READINGS, °F					
T/C-2	1578	1580	1579	1588	1591
T/C-3	1611	1615	1611	1621	1623
T/C-4	1546	1561	1570	1584	1595
T/C-5	1534	1553	1560	1575	1581
T/C-6	1405	1433	1439	1463	1456
T/C-7	1617	1634	1642	1650	1661
T/C-8	1434	1456	1467	1479	1495
T/C-9	1378	1406	1420	1437	1448
T/C-10	1447	1465	1478	1490	1503
T/C-11	1477	1489	1500	1509	1519
(Stack) **T/C-12**	1542	1549	1563	1566	1579

Flame Length >6'

Flame Width 5' (very wide)

Flame Characteristic impinging on side walls; lazy fire

COMMENTS:

BASELINE →

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 14, 1978 Type Burner RECIRC. TILE Test Run # 1/2-4 to 7

Burner ~~Gas~~ Oil Tip Sizing TID 766

Test No.	1/2-4	1/2-5	1/2-6	1/2-7	1/2-7
Time	1430	1515	1550	1715	1735
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	70.0	70.0	70.0	36.0	36.0
Burner Steam Pressure (psig)	90.0	91.0	91.0	46.5	47.0
Oil Flow (gpm)	0.652	0.615	0.6024	0.421	0.4373
Steam Flow (lb/hr)					
Type Oil	#2				→
Oil Temperature	60	60	62	64	63
Heat Release on Oil (MMBtu/hr)	4.91	4.63	4.54	3.17	3.30
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.08	-0.06	-0.07	-0.03	-0.04
Windbox Pressure					
O_2 (%)	3.7	2.8	6.0	—	—
Combustibles	0	0	0	—	—
Primary Air Door Opening	100% OPEN				→
Secondary Air Door Opening	100% OPEN				→
TEMPERATURE READINGS, °F					
T/C-2	1600	1622	1622	1579	1586
T/C-3	1631	1651	1647	1587	1571
T/C-4	1606	1623	1622	1565	1555
T/C-5	1588	1602	1601	1551	1535
T/C-6	1456	1472	1478	1483	1459
T/C-7	1663	1656	1648	1540	1532
T/C-8	1498	1501	1499	1436	1428
T/C-9	1453	1457	1458	1405	1393
T/C-10	1506	1506	1506	1440	1426
T/C-11	1517	1512	1508	1440	1426
T/C-12	1574	1564	1555	1471	1462
Flame Length	about the				
Flame Width	same				
Flame Characteristic	as before			lazy fire, blue smoke spot	no visible smoke emiss. from stack
COMMENTS:	O_2 SWING (optimum low)	O_2 SWING (CO limit)	O_2 SWING (high O_2)	50% CAP.	50% CAP.

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 15, 1978 Type Burner RECIRC. TILE (DBA-16 LO-NO$_x$) Test Run # 1/2-8

Burner Gas Tip Sizing PATTERN I (2 firing ports ea. 10° off radial ℄)

Test No.	1/2-8	→			
Time	0940	1000	1105	1130	1155
GAS FIRING					
Burner Gas Pressure (psig)	14.5	16.2	16.2	16.6	16.6
Gas Meter Flow (cfm)	22.06	→			
Meter Pressure (psig)	43.8	43.9	44.7	44.3	44.2
Meter Correction Factor	4.00	4.00	4.06	4.02	4.02
Heat Release on Gas (MMBtu/hr)	4.92	4.92	5.00	4.95	4.95
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.09	-0.09	-0.09	-0.09
Windbox Pressure					
O_2 (%)	—	—	1.8	1.8	—
Combustibles	—	—	0	0	—
Primary Air Door Opening	100% OPEN	→			
Secondary Air Door Opening	100% OPEN	→			
TEMPERATURE READINGS, °F					
T/C-2	1535	1557	1624	1645	1654
T/C-3	1563	1582	1636	1657	1664
T/C-4	1462	1482	1544	1570	1579
T/C-5	1431	1450	1518	1543	1553
T/C-6	1436	1456	1510	1525	1527
T/C-7	1531	1549	1602	1620	1627
T/C-8	1453	1465	1507	1524	1531
T/C-9	1351	1367	1418	1438	1448
T/C-10	1368	1383	1432	1450	1461
T/C-11	1444	1456	1497	1513	1520
(Stack) T/C-12	1488	1500	1539	1554	1561

Flame Length

Flame Width

Flame Characteristic difficult to see flame; red hot refractory

COMMENTS:

BASELINE →

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 15, 1978 **Type Burner** RECIRC. TILE (DBA · 16 LO·NO$_x$) **Test Run #** 1/2-9 to 13

Burner Gas Tip Sizing PATTERN I (as before)

Test No.	1/2-9	1/2-10	1/2-11	1/2-12	1/2-13
Time	1350	1450	1510	1550	1615
GAS FIRING					
Burner Gas Pressure (psig)	16.9	16.9	16.9	17.1	24.9
Gas Meter Flow (cfm)	22.06	22.30	22.47	22.64	25.57
Meter Pressure (psig)	44.5	44.6	44.6	45.2	44.9
Meter Correction Factor	4.04	4.04	4.04	4.09	4.07
Heat Release on Gas (MMBtu/hr)	4.97	5.03	5.07	5.17	6.49
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.08	-0.07	-0.10	-0.09	-0.14
Windbox Pressure					
O_2 (%)					
Combustibles					
Primary Air Door Opening	100% OPEN	→	→	→	→
Secondary Air Door Opening	100% OPEN	→	→	→	→
TEMPERATURE READINGS, °F					
T/C-2	1710	1729	1735	1735	1753
T/C-3	1717	1734	1740	1738	1756
T/C-4	1642	1661	1666	1670	1692
T/C-5	1612	1632	1640	1644	1660
T/C-6	1578	1613	1622	1633	1651
T/C-7	1680	1699	1698	1704	1762
T/C-8	1597	1613	1613	1619	1655
T/C-9	1507	1526	1533	1538	1561
T/C-10	1522	1539	1547	1553	1582
T/C-11	1574	1589	1591	1596	1625
T/C-12	1616	1629	1626	1633	1675

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

*	O_2 SWING (optimum low)	O_2 SWING (CO limit)	O_2 SWING (High O_2)	80% CAP. (Base line)	100% CAP.

KVB

TEST BURNER DATA SHEET

Test Date FEB. 15, 1978 **Type Burner** RECIRC. TILE **Test Run #** 1/2-13 to 15

Burner Gas Tip Sizing PATTERN I

Test No.	1/2 - 13	1/2 - 14	1/2 - 14	1/2 - 14	1/2 - 15
Time	1635	1715	1740	1800	1830
GAS FIRING					
Burner Gas Pressure (psig)	25.1	7.1	7.0	7.1	1.9
Gas Meter Flow (cfm)	28.43	13.67	13.82	13.58	7.59
Meter Pressure (psig)	44.9	45.7	45.6	46.1	45.9
Meter Correction Factor	4.07	4.12	4.11	4.14	4.14
Heat Release on Gas (MMBtu/hr)	6.46	3.14	3.17	3.14	1.75
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.14	-0.03	-0.04	-0.04	-0.025
Windbox Pressure					
O_2					
Combustibles					
Primary Air Door Opening	100% OPEN				→
Secondary Air Door Opening	100% OPEN				→
TEMPERATURE READINGS, °F					
T/C-2	1770	1702	1670	1653	1579
T/C-3	1774	1694	1660	1641	1558
T/C-4	1709	1629	1600	1583	1508
T/C-5	1676	1615	1586	1568	1506
T/C-6	1662	1616	1587	1570	1509
T/C-7	1781	1605	1578	1563	1440
T/C-8	1677	1576	1551	1536	1442
T/C-9	1578	1518	1492	1477	1405
T/C-10	1600	1523	1498	1483	1407
T/C-11	1643	1564	1539	1524	1438
T/C-12	1692	1580	1556	1542	1436
Flame Length					
Flame Width					
Flame Characteristic		looks like more recirc. around tile			
COMMENTS:	100% CAP.	50% CAP.	50% CAP.	50% CAP.	25% CAP.

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 16, 1978 Type Burner TERTIARY AIR (DBA-PC-16, LO-NOx) Test Run # 1/3-1

Burner Gas Tip Sizing PATTERN II (2 firing ports at 15° and 45° off radial ℄)

Test No.	1/3-1			→	
Time	1540	1630	1700	1730	
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)	12.12			→	
Meter Pressure (psig)	47.0			→	
Meter Correction Factor	4.21			→	
Heat Release on Gas (MMBtu/hr)	2.85			→	
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.19	-0.19	-0.19	-0.19	
Windbox Pressure					
O_2 (%)	11.7	10.8	10.8	11.9	
Combustibles	0	0	0	0	
Primary Air Door Opening	100%			→	
Secondary Air Door Opening	100%			→	
Tertiary Air Door Opening	100%			→	
TEMPERATURE READINGS, °F					
T/C-2	712	825	892	923	
T/C-3	707	824	895	926	
T/C-4	657	757	816	842	
T/C-5	614	725	791	823	
T/C-6	621	729	797	828	
T/C-7	703	807	865	893	
T/C-8	635	743	795	831	
T/C-9	600	708	773	803	
T/C-10	615	723	783	814	
T/C-11	660	781	854	885	
(Stack) T/C-12	768	877	935	963	

Flame Length 6'

Flame Width 2½'

Flame Characteristic narrow, swirling, blue at tip, yellow above

COMMENTS: cold firebox

HEAT-UP →

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 17, 1978 **Type Burner** TERTIARY AIR (DBA-PC-16, LOW-NOx) **Test Run #** 1/3-2

Burner ~~Gas~~ Oil **Tip Sizing** Tip 864

Test No.	1/3-2				→
Time	0900	0930	1010	1040	1115
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	51.0	50.0	51.0	50.5	51.0
Burner Steam Pressure (psig)	81.0	78.0	80.0	79.0	81.0
Oil Flow (gpm)	0.598	0.606	0.630	0.632	0.617
Steam Flow (lb/hr)	-				
Type Oil	#6				→
Oil Temperature	238	239	238	238	240
Heat Release on Oil (MMBtu/hr)	4.78	4.84	5.03	5.05	4.93
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.12	-0.12	-0.12	-0.12	-0.11
Windbox Pressure					
O_2 (%)	4.2	3.6	3.6	3.1	4.0
Combustibles	0	0	0	0	0
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
Tertiary Air Door Opening	100%				→
TEMPERATURE READINGS, °F					
T/C-2	1397	1485	1535	1572	1602
T/C-3	1412	1506	1578	1615	1642
T/C-4	1337	1449	1466	1503	1535
T/C-5	1318	1437	1443	1482	1516
T/C-6	1283	1456	1407	1443	1473
T/C-7	1444	1510	1556	1584	1612
T/C-8	1374	1480	1487	1515	1539
T/C-9	1239	1407	1354	1387	1417
T/C-10	1283	1433	1399	1430	1458
T/C-11	1386	1454	1499	1528	1549
(Stack) T/C-12	1449	1512	1554	1581	1600

Flame Length ~7'

Flame Width 3'

Flame Characteristic uniform

COMMENTS:

BASELINE →

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 17, 1978 **Type Burner** TERTIARY AIR **Test Run #** 1/3-3 to 6

Burner ~~Gas~~ Oil **Tip Sizing** Tip 864

Test No.	1/3-3	1/3-4	1/3-4	1/3-5	1/3-6
Time	1315	1350	1440	1545	1610
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	50.0	50.0	50.0	50.0	49.0
Burner Steam Pressure (psig)	79.0	79.0	80.0	79.0	78.0
Oil Flow (gpm)	0.621	0.629	0.632	0.593	0.588
Steam Flow (lb/hr)	—	—	—	—	—
Type Oil	#6	→	→	→	→
Oil Temperature	242	242	243	243	242
Heat Release on Oil (MMBtu/hr)	4.96	5.03	5.05	4.74	4.70
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.07	-0.07	-0.06	-0.10
Windbox Pressure	—	—	—	—	—
O_2 (%)	3.0-3.2	.95	.7-.8	2.55	4.85
Combustibles	0	0	0.2	0	0
Primary Air Door Opening	100%	→	→	→	→
Secondary Air Door Opening	100%	→	→	→	→
Tertiary Air Door Opening	100%	→	→	→	→
TEMPERATURE READINGS, °F					
T/C-2	1662	1684	1712	1688	1715
T/C-3	1694	1713	1738	1695	1721
T/C-4	1606	1630	1659	1654	1653
T/C-5	—	—	1635	1642	1632
T/C-6	1544	1562	1584	1623	1584
T/C-7	1674	1694	1702	1658	1663
T/C-8	1591	1608	1618	1627	1604
T/C-9	1490	1507	1525	1578	1521
T/C-10	1525	1541	1556	1599	1548
T/C-11	1599	1612	1622	1610	1608
T/C-12	1647	1659	1662	1643	1642
Flame Length		~8'		~8'	~7'
Flame Width		3½'		3½'	3'
Flame Characteristic		dark area in center of flame near base	smoky flame	still a wide flame	narrower flame + shorter
COMMENTS:		wider flame, billowy			
	O_2 SWING (Baseline)	O_2 SWING (CO limit)	O_2 SWING (CO limit)	O_2 SWING (optimum low)	O_2 SWING (High O_2)

Data Sheet 6015-20

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TEST BURNER DATA SHEET

Test Date FEB. 18, 1978 **Type Burner** TERTIARY AIR (DBA-PC-16 LO-NOx) **Test Run #** 1/3-7 to 8

Burner Gas Tip Sizing PATTERN II (2 firing ports at 15° and 45° off radial ℄)

Test No.	1/3-7	1/3-7	1/3-8	1/3-8	1/3-8
Time	0830	0900	0955	1030	1100
GAS FIRING					
Burner Gas Pressure (psig)	1.5	1.5	3.0	3.25	3.25
Gas Meter Flow (cfm)	10.27	10.26	13.27	14.22	14.22
Meter Pressure (psig)	45.9	45.8	45.4	45.5	45.7
Meter Correction Factor	4.14	4.13	4.10	4.10	4.12
Heat Release on Gas (MMBtu/hr)	2.37	2.36	3.04	3.25	3.27
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.03	-0.03	-0.05	-0.06	-0.06
Windbox Pressure	—	—	—	—	—
O_2 (%)	2.8	3.75	2.5	3.0	2.6
Combustibles	—	—	—	—	—
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
Tertiary Air Door Opening	100%				→
TEMPERATURE READINGS, °F					
T/C-2	1108	1147	1245	1293	1333
T/C-3	1064	1128	1256	1311	1353
T/C-4	1068	1105	1194	1238	1274
T/C-5	1051	1083	1163	1205	1242
T/C-6	1028	1061	1128	1163	1197
T/C-7	1090	1116	1217	1253	1290
T/C-8	1052	1075	1158	1194	1230
T/C-9	999	1021	1089	1124	1155
T/C-10	1013	1036	1106	1143	1175
T/C-11	1043	1070	1158	1199	1236
(Stack) T/C-12	1096	1122	1216	1252	1282
Flame Length	5½'	5'	flame appearance similar to that at 35% cap.; firebox beginning to glow		
Flame Width	3'	3'			
Flame Characteristic	yellow; blue base; short, lazy flame				
COMMENTS:	35% CAP.	35% CAP.	50% CAP.	50% CAP	50% CAP

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB.18, 1978 **Type Burner** TERTIARY AIR **Test Run #** 1/3-8

Burner Gas Tip Sizing PATTERN II (as before)

Test No.	1/3-8	1/3-8			
Time	1120	1140			
GAS FIRING					
Burner Gas Pressure (psig)	3.25	3.25			
Gas Meter Flow (cfm)	14.22	14.22			
Meter Pressure (psig)	45.5	45.4			
Meter Correction Factor	4.10	4.10			
Heat Release on Gas (MMBtu/hr)	3.25	3.25			
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.06	-0.06			
Windbox Pressure	—	—			
O_2 (%)	2.5	—			
Combustibles	—	—			
Primary Air Door Opening	100%	100%			
Secondary Air Door Opening	100%	100%			
Tertiary Air Door Opening	100%	100%			
TEMPERATURE READINGS, °F					
T/C-2	1357	1374			
T/C-3	1378	1393			
T/C-4	1297	1313			
T/C-5	1264	1279			
T/C-6	1214	1220			
T/C-7	1310	1318			
T/C-8	1249	1262			
T/C-9	1173	1183			
T/C-10	1193	1205			
T/C-11	1255	1267			
T/C-12	1300	1314			

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

50% CAP. 50% CAP.

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 20, 1978 **Type Burner** TERTIARY AIR **Test Run #** 1/3-9

Burner Gas Tip Sizing PATTERN II (2 firing ports at 15° and 45° off radial ℄)

Test No.	1/3-9				→
Time	0855	1030	1100	1200	1230
GAS FIRING					
Burner Gas Pressure (psig)	5.1	5.1	5.1	5.1	5.0
Gas Meter Flow (cfm)	22.99	22.72	23.08	—	—
Meter Pressure (psig)	47.4	46.0	46.0	44.9	44.9
Meter Correction Factor	4.24	4.14	4.14	4.07	4.07
Heat Release on Gas (MMBtu/hr)	5.44	5.25	5.33	—	—
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.18	-0.16	-0.17	-0.18	-0.18
Windbox Pressure	—	—	—	—	—
O_2 (%)	2.4	2.8	3.0	2.7	2.4-2.7
Combustibles	0	0	.0	0	0
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
Tertiary Air Door Opening	100%				→
TEMPERATURE READINGS, °F					
T/C-2	1663	1713	1718	1722	1729
T/C-3	1644	1670	1674	1660	1665
T/C-4	1617	1658	1663	1669	1675
T/C-5	1568	1612	1618	1627	1634
T/C-6	1484	1551	1554	1563	1570
T/C-7	1636	1678	1682	1684	1690
T/C-8	1557	1605	1610	1618	1625
T/C-9	1462	1510	1517	1527	1533
T/C-10	1489	1534	1540	1560	1556
T/C-11	1544	1594	1598	1611	1618
(Stack) **T/C-12**	1587	1631	1635	1647	1654

Flame Length ?

Flame Width ~ 3½

Flame Characteristic refractory glowing orange; hard to see

COMMENTS: flame; flame is blue below top of tile

BASELINE →

Data Sheet 6015-20

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TEST BURNER DATA SHEET

Test Date FEB. 20, 1978 Type Burner TERTIARY AIR Test Run # 1/3- 10 to 13

Burner Gas Tip Sizing PATTERN II (as before)

Test No.	1/3-10	1/3-11	1/3-11	1/3-12	1/3-13
Time	1345	1410	1435	1450	1520
GAS FIRING					
Burner Gas Pressure (psig)	5.3	5.2	5.1	5.1	5.2
Gas Meter Flow (cfm)	—	23.08	23.25	23.17	23.17
Meter Pressure (psig)	—	41.9	45.0	45.5	45.8
Meter Correction Factor	—	4.07	4.07	4.10	4.13
Heat Release on Gas (MMBtu/hr)	—	5.24	5.28	5.30	5.34
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.14	-0.14	-0.15	-0.17	-0.23
Windbox Pressure	——	——	——	——	——
O_2 (%)	0.2	0.2	0.2	1.2	3.3
Combustibles	0.1	0.1	0.1	0	0
Primary Air Door Opening	100%	—	—	—	→
Secondary Air Door Opening	100%	—	—	—	→
Tertiary Air Door Opening	100%	—	—	—	→
TEMPERATURE READINGS, °F					
T/C-2	1765	1769	1773	1777	1765
T/C-3	1736	1737	1741	1747	1716
T/C-4	1715	1715	1720	1722	1708
T/C-5	1669	1673	1678	1681	1672
T/C-6	1607	1609	1613	1615	1612
T/C-7	1738	1737	1741	1742	1723
T/C-8	1666	1665	1670	1670	1657
T/C-9	1568	1570	1575	1576	1571
T/C-10	1593	1594	1598	1600	1593
T/C-11	1658	1658	1663	1663	1657
T/C-12	1700	1699	1703	1700	1688
Flame Length					
Flame Width					
Flame Characteristic	fire almost completely transparent				
COMMENTS:	O_2 SWING (CO limit)	O_2 SWING (optimum low)	O_2 SWING (optimum low)	O_2 SWING (med. low)	O_2 SWING (High O_2)

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 20, 1978 **Type Burner** TERTIARY AIR **Test Run #** 1/3-13 to 14

Burner Gas Tip Sizing PATTERN II (as before)

Test No.	1/3-13	1/3-14	→	→	
Time	1550	1700	1730	1755	
GAS FIRING					
Burner Gas Pressure (psig)	5.2	7.6	7.6	7.4	
Gas Meter Flow (cfm)	23.08	28.71	28.57	28.30	
Meter Pressure (psig)	46.0	45.0	45.2	45.4	
Meter Correction Factor	4.14	4.07	4.09	4.10	
Heat Release on Gas (MMBtu/hr)	5.33	6.52	6.52	6.47	
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.20	-0.23	-0.23	-0.23	
Windbox Pressure	—	—	—	—	
O_2 (%)	3.5	2.2	1.8-2.0	2.25	
Combustibles	0	0	0	0	
Primary Air Door Opening	100%	→	→	→	
Secondary Air Door Opening	100%	→	→	→	
Tertiary Air Door Opening	100%	→	→	→	
TEMPERATURE READINGS, °F					
T/C-2	1761	1800	1810	1821	
T/C-3	1695	1711	1716	1724	
T/C-4	1704	1746	1755	1765	
T/C-5	1669	1705	1715	1725	
T/C-6	1612	1651	1662	1672	
T/C-7	1722	1799	1809	1818	
T/C-8	1656	1714	1724	1734	
T/C-9	1569	1609	1619	1629	
T/C-10	1591	1639	1649	1659	
T/C-11	1655	1707	1718	1727	
T/C-12	1688	1748	1758	1767	

Flame Length

Flame Width

Flame Characteristic

COMMENTS:	O_2 SWING (High O_2)	100% CAP.	100% CAP.	100% CAP.

Data Sheet 6015-20

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TEST BURNER DATA SHEET

Test Date FEB. 22, 1978 Type Burner TERTIARY AIR Test Run # 1/3-15 to 19

Burner ~~Gas~~ Oil Tip Sizing Tip 764

Test No.	1/3-15	1/3-16	1/3-17	1/3-18	1/3-19
Time	1100	1115	1130	1140	1145
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	59.0	59.0	59.0-62.0		59.0
Burner Steam Pressure (psig)	89.0	90.0	90.0		90.0
Oil Flow (gpm)	0.593	0.503	0.561		0.531
~~Steam Flow (lb/hr)~~ NO (ppm) uncorr.	460	430-470	390		300
Type Oil	Shale				→
Oil Temperature	165	165	165		126
Heat Release on Oil (MMBtu/hr)	4.6	3.9	4.4		4.1
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.09	-0.10		-0.11
Windbox Pressure	—	—	—		—
O_2 (%)	7.0	3.6	2.6		1.2
Combustibles	0	0	0		0
Primary Air Door Opening	100%	50%	50%		25%
Secondary Air Door Opening	100%	50%	50%		3/8
Tertiary Air Door Opening	100%	50%	50%		50%
TEMPERATURE READINGS, °F					
T/C-2					
T/C-3					
T/C-4					
T/C-5					
T/C-6					
T/C-7					
T/C-8					
T/C-9					
T/C-10					
T/C-11					
(Stack) T/C-12	1519	1531	1540		1544

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

SHALE OIL →

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KVB

TEST BURNER DATA SHEET

Test Date FEB. 22, 1978 Type Burner TERTIARY AIR Test Run # 1/3-20 to 23

Burner Gas Tip Sizing PATTERN II (2 firing ports at 15° and 45° off radial ℄)
Oil Tip 764 used for shale oil; Oil Tip 864 used for No.6 oil

Test No.	1/3-20	1/3-21	1/3-22	1/3-23	
Time	1200	1230	1655	1755	
GAS FIRING					
Burner Gas Pressure (psig)		–			
Gas Meter Flow (cfm)		–			
Meter Pressure (psig)		–			
Meter Correction Factor		–			
Heat Release on Gas (MMBtu/hr)		4.8			
OIL FIRING					
Burner Oil Pressure (psig)	60.0		51.0	50.5	
Burner Steam Pressure (psig)	90.0		80.0	80.0	
Oil Flow (gpm)	0.564		0.595	0.585	
~~Steam Flow (lb/hr)~~ NO (ppm) uncorr.	310				
Type Oil	Shale				
Oil Temperature	127				
Heat Release on Oil (MMBtu/hr)	4.8				
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.24				
Windbox Pressure	—	—	—	—	
O_2 (%)	4.0				
Combustibles	0				
Primary Air Door Opening	CLOSED	100%	100%	1/8	
Secondary Air Door Opening	25%	100%	100%	100%	
Tertiary Air Door Opening	100%	100%	100%	100%	
TEMPERATURE READINGS, °F					
T/C-2			1676	1686	
T/C-3			1667	1687	
T/C-4			1638	1649	
T/C-5			1609	1622	
T/C-6			1558	1565	
T/C-7			1689	1701	
T/C-8			1616	1624	
T/C-9			1535	1547	
T/C-10			1560	1572	
T/C-11			1616	1620	
T/C-12	1551	—	1658	1662	
Flame Length			~8'	>8'	
Flame Width			2½'	2'	
Flame Characteristic			bright yellow narrow uniform	long, narrow flame sparks shooting off periphery of flame	
COMMENTS:	SHALE OIL	NATURAL GAS	NO.6 OIL (Baseline)	NO.6 OIL (Primary Air 1/8 Open)	

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 23, 1978 **Type Burner** TERTIARY AIR (DBA - PC - '16) **Test Run #** 1/3-24a to 26

Burner Gas Tip Sizing PATTERN II (2 firing ports at 15° off either side of ℄)

Test No.	1/3-24a	1/3-24a	1/3-24b	1/3-25	1/3-26
Time	1210	1415	1525	1545	1605
GAS FIRING					
Burner Gas Pressure (psig)	7.0	7.1	6.8	6.8	6.8
Gas Meter Flow (cfm)	22.81	23.08	24.29	23.44	23.08
Meter Pressure (psig)	43	42.2	39.8	39.8	40.0
Meter Correction Factor	3.93	3.88	3.65	3.65	3.73
Heat Release on Gas (MMBtu/hr)	5.00	5.00	4.95	4.77	4.80
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.10	-0.12	-0.14	-0.11
~~Windbox Pressure~~ NO (ppm) uncorr.	—	70	95	80	80
O_2 (%)	1.8	2.4	2.4-2.6	1.9-2.2	1.4
Combustibles	0	0	0	0	0
Primary Air Door Opening	100%	→	→	CLOSED	50%
Secondary Air Door Opening	100%	→	→	→	→
Tertiary Air Door Opening	100%	→	→	→	→
TEMPERATURE READINGS, °F					
T/C-2	1488	1430	1606	1616	
T/C-3	1492	1415	1625	1641	
T/C-4	1494	1433	1608	1617	
T/C-5	1486	1427	1597	1607	
T/C-6	1414	1388	1534	1541	
T/C-7	1673	1600	1742	1747	
T/C-8	1549	1479	1630	1636	
T/C-9	1430	1371	1536	1544	
T/C-10	1474	1410	1572	1578	
T/C-11	1529	1449	1610	1616	
(Stack) T/C-12	1612	1532	1678	1682	
Flame Length	~10'			~10'	~10'
Flame Width	2'			2'	2'
Flame Characteristic	Very long narrow, no swirl			not much change	

COMMENTS:

BASELINE → PRIMARY CLOSED PRIMARY 50% OPEN

Data Sheet 6015-20

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TEST BURNER DATA SHEET

Test Date FEB. 23 1978 **Type Burner** TERTIARY AIR **Test Run #** 1/3-27 to 31

Burner Gas Tip Sizing PATTERN II (as before)

Test No.	1/3-27	1/3-28	1/3-29	1/3-30	1/3-31
Time	1625	1645	1705	1730	1755
GAS FIRING					
Burner Gas Pressure (psig)	6.8	6.8	6.8	7.1	7.0
Gas Meter Flow (cfm)	23.81	24.19	24.29	23.90	23.53
Meter Pressure (psig)	40.0	40.12	39.9	41.0	42.0
Meter Correction Factor	3.73	3.73	3.73	3.80	3.87
Heat Release on Gas (MMBtu/hr)	4.96	5.04	5.06	5.07	5.08
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.24	-0.12	-0.13	-0.18	-0.16
~~Windbox Pressure~~ NO (ppm) uncor.	75-80	90	85-90	80	80
O_2 (%)	1.9	2.3	1.9-2.2	2.0	2.2-2.4
Combustibles	0	0	0	0	0
Primary Air Door Opening	100%	100%	50%	CLOSED	CLOSED
Secondary Air Door Opening	CLOSED	50%	50%	50%	100%
Tertiary Air Door Opening	100%	→	→	→	50%
TEMPERATURE READINGS, °F					
T/C-2	1656	1667		1692	
T/C-3	1679	1672		1703	
T/C-4	1655	1665		1690	
T/C-5	1644	1655		1680	
T/C-6	1573	1584		1602	
T/C-7	1778	1781		1810	
T/C-8	1672	1675		1698	
T/C-9	1581	1590		1612	
T/C-10	1615	1622		1646	
T/C-11	1654	1658		1677	
T/C-12	1718	1717		1741	
Flame Length	~10'	~10'	~10'	~10'	
Flame Width	2'	2'	2½'	2½'	
Flame Characteristic	about same		fire a little ragged at edges	same	
COMMENTS:	SECONDARY CLOSED	SECONDARY 50% OPEN	PRIM. & SEC. 50% OPEN	PRIM. CLOSED SEC. 50% OPEN	PRIM. CLOSED TERT. 50% OPEN

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TEST BURNER DATA SHEET

Test Date Feb. 23, 1978 **Type Burner** Tertiary Air **Test Run #** 1/3-32 to 36

Burner Gas Tip Sizing Pattern II (as before)

Test No.	1/3-32	1/3-33	1/3-34	1/3-35	1/3-36
Time	1825	1840	1915	1950	2015
GAS FIRING					
Burner Gas Pressure (psig)	7.0	7.0	7.1	7.1	7.0
Gas Meter Flow (cfm)	23.81	23.08	22.90	22.90	23.08
Meter Pressure (psig)	42.0	43.9	44.2	44.3	44.1
Meter Correction Factor	3.87	4.00	4.01	4.02	4.01
Heat Release on Gas (MMBtu/hr)	5.14	5.15	5.12	5.14	5.16
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.14	-0.10	-0.08	-0.11	-0.10
~~Windbox Pressure~~ NO (ppm) uncor.	90	90	75	95	80-85
O_2 (%)	2.0-2.4	1.8-2.2	0.6-0.8	2.8-3.0	2.0-2.4
Combustibles	—	—	—	—	—
Primary Air Door Opening	50%	100%	100%	100%	50%
Secondary Air Door Opening	50%	100%	100%	100%	100%
Tertiary Air Door Opening	50%	100%	100%	100%	100%
TEMPERATURE READINGS, °F					
T/C-2	1726		1748	1750	1753
T/C-3	1724		1769	1772	1775
T/C-4	1719		1737	1739	1745
T/C-5	1711		1729	1733	1738
T/C-6	1617		1626	1621	1622
T/C-7	1828		1848	1839	1851
T/C-8	1725		1739	1743	1749
T/C-9	1640		1657	1663	1670
T/C-10	1673		1690	1695	1704
T/C-11	1699		1712	1715	1722
T/C-12	1758		1772	1773	1781
Flame Length	~10'	10'		~10'	
Flame Width	2'	2'		2'	
Flame Characteristic		not much change in overall appearance	flame slightly shorter		same flame shape
COMMENTS:	ALL REGISTERS 50% OPEN	BASELINE	O_2 SWING (CO limit)	O_2 SWING (High O_2)	PRIM. 50% OPEN 3% O_2

KVB

TEST BURNER DATA SHEET

Test Date FEB. 23, 1978 **Type Burner** TERTIARY AIR **Test Run #** 1/3-37 to 38

Burner Gas Tip Sizing PATTERN II (as before)

Test No.	1/3-37	1/3-38			
Time	2050	2115			
GAS FIRING					
Burner Gas Pressure (psig)	7.0	7.0			
Gas Meter Flow (cfm)	23.08	23.26			
Meter Pressure (psig)	44.0	44.0			
Meter Correction Factor	4.00	4.00			
Heat Release on Gas (MMBtu/hr)	5.15	5.19			
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.11	-0.08			
~~Windbox Pressure~~ NO(ppm) uncor.	90	70-75			
O_2 (%)	2.7-2.9	0.6-0.7			
Combustibles	—	—			
Primary Air Door Opening	50%	50%			
Secondary Air Door Opening	100%	100%			
Tertiary Air Door Opening	100%	100%			
TEMPERATURE READINGS, °F					
T/C-2	1753	1761			
T/C-3	1772	1783			
T/C-4	1749	1758			
T/C-5	1740	1746			
T/C-6	1639	1660			
T/C-7	1853	1857			
T/C-8	1750	1754			
T/C-9	1672	1676			
T/C-10	1706	1709			
T/C-11	1722	1726			
T/C-12	1780	1780			

Flame Length ~10'

Flame Width 2½'

Flame Characteristic lazy flame

COMMENTS:

PRIM. 50% OPEN PRIM. 50% OPEN
4% O_2 (co limit)

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 24, 1978 Type Burner TERTIARY AIR (DBA-[illegible]-16) Test Run # 1/3-39 to 43

Burner ~~Gas~~ Oil Tip Sizing Tip 864

Test No.	1/3-39	1/3-40	1/3-41	1/3-42	1/3-43
Time	1050	1125	1230	1250	1320
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	51.0	50.0	51.0	52.0	52.0
Burner Steam Pressure (psig)	80.0	77.5	80.5	82.5	82.5
Oil Flow (gpm)	0.594	0.591	0.592	0.568	0.581
Steam Flow (lb/hr)	—	—	—	—	—
Type Oil	#6				→
Oil Temperature	246				→
Heat Release on Oil (MMBtu/hr)	4.75	4.72	4.73	4.54	4.64
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.09	-0.16	-0.11	-0.13	-0.20
~~Windbox Pressure~~ NO(ppm) uncor.	275	185-190	260	245	260
O_2 (%)	3.2	3.2-4.0	2.7-2.9	3.2	3.2
Combustibles	0	0	0	0	0
Primary Air Door Opening	100%	10%	50%	50%	100%
Secondary Air Door Opening	100%	100%	100%	50%	CLOSED
Tertiary Air Door Opening	100%				→
TEMPERATURE READINGS, °F					
T/C-2	1486	1526	1591		
T/C-3	1526	1567	1617		
T/C-4	1453	1492	1541		
T/C-5	1428	1469	1525		
T/C-6	1368	1406	1457		
T/C-7	1546	1573	1610		
T/C-8	1465	1495	1538		
T/C-9	1372	1405	1446		
T/C-10	1400	1432	1473		
T/C-11	1467	1492	1528		
(Stack) T/C-12	1527	1547	1581		
Flame Length	~8'	~8'	~7'	6'	
Flame Width	2½'	2½'	3½'	4½'	
Flame Characteristic	uniform narrow	similar Some sparks	lazy, wide flame	flame impinging on wall shorter, wider	crooked flame impinging on wall
COMMENTS:	BASELINE	PRIMARY 10% OPEN	PRIMARY 50% OPEN	PRIM. & SEC. 50% OPEN	SECONDARY CLOSED

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date FEB. 24, 1978 Type Burner TERTIARY AIR Test Run # 1/3-44 to 45

Burner ~~Gas~~ Oil Tip Sizing Tip 864

Test No.	1/3-44	1/3-45			
Time	1345	1355			
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	51.5	50.0			
Burner Steam Pressure (psig)	81.5	78.0			
Oil Flow (gpm)	0.593	0.584			
Steam Flow (lb/hr)	—	—			
Type Oil	#6	#6			
Oil Temperature	247	247			
Heat Release on Oil (MMBtu/hr)	4.74	4.66			
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.12	-0.13			
~~Windbox Pressure~~ NO (ppm) uncor	190	—			
O_2 (%)	3.0-3.3	4.0			
Combustibles	0	0			
Primary Air Door Opening	10%	10%			
Secondary Air Door Opening	100%	100%			
Tertiary Air Door Opening	100%	100%			
TEMPERATURE READINGS, °F					
T/C-2	1631				
T/C-3	1639				
T/C-4	1578				
T/C-5	1561				
T/C-6	1503				
T/C-7	1621				
T/C-8	1562				
T/C-9	1478				
T/C-10	1502				
T/C-11	1553				
(Stack) T/C-12	1594				
Flame Length	~8'				
Flame Width	3'				
Flame Characteristic	Coke build-up on tile causing sparks				

COMMENTS:

OPT. REQ. SETTING ⟶

3% O_2 4% O_2

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-13-78 **Type Burner** MA-16 **Test Run #** 1/4

Burner Gas Tip Sizing Pattern II

Test No.	1/4-1	1/4-1	1/4-2	1/4-3	1/4-4
Time	13:30	14:00	14:30	14:50	15:20
GAS FIRING					
Burner Gas Pressure (psig)	15.0	15.0	15.0	15.5	16.0
Gas Meter Flow (cfm)	24.79	25.75	25.0	25.0	24.79
Meter Pressure (psig)	41	39.8	40	40.5	42
Meter Correction Factor	3.8	3.7	3.73	3.76	3.87
Heat Release on Gas (MMBtu/hr)	5.25	5.32	5.2	5.25	5.35
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.15	-0.15	-0.19	-0.36	-0.23
Windbox Pressure					
O_2	3.1	3.3	1.9	2.4	2.5
Combustibles	0	0	0	0	0
Primary Air Door Opening %	100	100	100	100	50
Secondary Air Door Opening %	100	100	50	20	50
TEMPERATURE READINGS, °F					
T/C-2	1154	1222	1310	1374	1434
T/C-3	1214	1278	1350	1402	1442
T/C-4	1053	1111	1187	1267	1325
T/C-5	1002	1065	1152	1226	1295
T/C-6	974	1041	1132	1192	1252
T/C-7	1202	1266	1349	1399	1473
T/C-8	1143	1211	1288	1325	1387
T/C-9	987	1046	1128	1175	1234
T/C-10	1035	1097	1182	1223	1284
T/C-11	835	886	950	975	1013
T/C-12					

Flame Length

Flame Width

Flame Characteristic transparent →

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-13-78 **Type Burner** MA-16 **Test Run #** 1/4

Burner Gas Tip Sizing Pattern II

Test No.	1/4-5				
Time	16:10				
GAS FIRING					
Burner Gas Pressure (psig)	16				
Gas Meter Flow (cfm)	24.79				
Meter Pressure (psig)	42				
Meter Correction Factor	3.87				
Heat Release on Gas (MMBtu/hr)	5.35				
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.13				
Windbox Pressure					
O_2	2.5				
Combustibles	0				
Primary Air Door Opening	100				
Secondary Air Door Opening	100				
TEMPERATURE READINGS, °F					
T/C-2	1521				
T/C-3	1528				
T/C-4	1412				
T/C-5	1394				
T/C-6	1341				
T/C-7	1544				
T/C-8	1424				
T/C-9	1323				
T/C-10	1366				
T/C-11	1056				
T/C-12	-				

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-13-78 **Type Burner** MA-16 **Test Run #** 1/5

Burner Gas Tip Sizing Pattern II

Test No.	1/5-1	1/5-2	1/5-3	1/5-4	
Time	12:00	12:10	12:20	12:30	
GAS FIRING					
Burner Gas Pressure (psig)	15.0	15.0	15.0	15.0	
Gas Meter Flow (cfm)	24	24	24	24	
Meter Pressure (psig)	44	44	44	44	
Meter Correction Factor	4.0	4.0	4.0	4.0	
Heat Release on Gas (MMBtu/hr)	5.4	5.4	5.4	5.4	
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)	50	78	50	0	
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.13	-0.13	-0.13	-0.13	
Windbox Pressure					
O_2					
Combustibles					
Primary Air Door Opening %	100	100	100	100	
Secondary Air Door Opening %	100	100	100	100	
TEMPERATURE READINGS, °F					
T/C-2					
T/C-3					
T/C-4					
T/C-5					
T/C-6	out of service				
T/C-7					
T/C-8					
T/C-9					
T/C-10					
T/C-11					
T/C-12					

Flame Length ~7'

Flame Width ~4'

Flame Characteristic

COMMENTS:

KVB

TEST BURNER DATA SHEET

Test Date 3-14-78 Type Burner MA-16 Test Run # 1/6

Burner Gas Tip Sizing Pattern II

Test No.	1/6-1	1/6-1	1/6-2	1/6-3	1/6-4
Time	9:30	10:00	10:50	11:45	13:10
GAS FIRING					
Burner Gas Pressure (psig)	13.0	13.8	14.5	13.6	12.4
Gas Meter Flow (cfm)	-	24.79	23.8	24	23.26
Meter Pressure (psig)	-	41.9	43	40	38.4
Meter Correction Factor	-	3.87	3.93	3.73	3.6
Heat Release on Gas (MMBtu/hr)	5.4	5.35	5.22	5.0	4.67
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
~~Steam Flow (lb/hr)~~ ΔH "H_2O	-	-	1.9	1.9	1.9
~~Type Oil~~ Dist. in Blr. ft	-	-	2	3	4
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	- 0.14	-0.14	- 0.7	-0.7	-0.5
Windbox Pressure					
O_2	2.8	3.0	2.8	3.8	1.9
Combustibles	0	0	0	0	0
Primary Air Door Opening	100	100	100	100	100
Secondary Air Door Opening	100	100	100	100	100
TEMPERATURE READINGS, °F					
T/C-2	1342	1392	1495	1531	1615
T/C-3	1334	1392	1531	1540	1640
T/C-4	1253	1301	1442	1478	1553
T/C-5	1230	1278	1409	1453	1532
T/C-6	1210	1363	1322	1363	1432
T/C-7	1396	1434	1556	1574	1623
T/C-8	1333	1364	1402	1429	1473
T/C-9	1206	1248	1330	1367	1419
T/C-10	1239	1280	1376	1409	1460
T/C-11	979	1004	1038	1058	1080
T/C-12					

Flame Length

Flame Width

Flame Characteristic transparent ⟶

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-14-78 Type Burner MH-16 Test Run # 1/6

Burner Gas Tip Sizing Pattern II.

Test No.	1/6-5	1/6-6	1/6-7	1/6-8	1/6-9
Time	13:30	14:10	14:50	15:10	15:35
GAS FIRING					
Burner Gas Pressure (psig)	12.5	15.4	15.0	15.0	13.6
Gas Meter Flow (cfm)	25.53	25.75	25.75	25.53	25.53
Meter Pressure (psig)	36.5	40	39	39	36
Meter Correction Factor	3.49	3.73	3.66	3.66	3.46
Heat Release on Gas (MMBtu/hr)	4.97	5.36	5.28	5.21	4.93
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
~~Steam Flow (lb/hr)~~ ΔH "H₂O	1.9	1.9	1.5	1.5	–
~~Type Oil~~ Dist. in Blr. ft	5	5	5	5	–
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.5	-0.11	-0.12	-0.07	-0.11
Windbox Pressure					
O_2	2.3	1.3	1.0	2.3	2.9
Combustibles	0	0	0	0	0
Primary Air Door Opening	100	100	100	100	100
Secondary Air Door Opening	100	3/4"	5/8"	100	100
TEMPERATURE READINGS, °F					
T/C-2	1625	1676	1716	1726	1728
T/C-3	1645	1701	1741	1750	1743
T/C-4	1562	1618	1658	1608	1662
T/C-5	1542	1588	1631	1642	1641
T/C-6	1450	1504	1552	1567	1574
T/C-7	1636	1696	1727	1736	1704
T/C-8	1497	1547	1592	1605	1614
T/C-9	1435	1474	1516	1530	1538
T/C-10	1475	1516	1557	1574	1575
T/C-11	1090	1115	1148	1158	1172
T/C-12					

Flame Length

Flame Width

Flame Characteristic transparent →

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date *3-15-78* Type Burner *MA-16* Test Run #

Burner ~~Gas~~ Tip Sizing *Tip 764*

Test No.	1/6-10	1/6-10	1/6-11		
Time	9:50	10:15	10:45		
GAS FIRING					
Burner Gas Pressure (psig)					
~~Gas Meter Flow (cfm)~~ ΔH "H_2O			1.9		
~~Meter Pressure (psig)~~ Dist. in			3'		
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75	75	75		
Burner Steam Pressure (psig)	100	100	100		
Oil Flow (gpm)	0.63	0.63	0.62		
Steam Flow (lb/hr)	118	117	121		
Type Oil	#6	#6	#6		
Oil Temperature	300	300	300		
Heat Release on Oil (MMBtu/hr)	5.48	5.46	5.39		
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.7	-0.8	-0.6		
Windbox Pressure					
O_2	3.2	4.1	3.1		
Combustibles	0	0	0		
Primary Air Door Opening	100	100	50		
Secondary Air Door Opening	100	100	60		
TEMPERATURE READINGS, °F					
T/C-2	1481	1539	1597		
T/C-3	1520	1586	1632		
T/C-4	1415	1472	1530		
T/C-5	1380	1438	1511		
T/C-6	1360	1426	1471		
T/C-7	1530	1580	1613		
T/C-8	1443	1488	1503		
T/C-9	1326	1375	1427		
T/C-10	1364	1410	1459		
T/C-11	1077	1106	1117		
T/C-12					

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

KVB

TEST BURNER DATA SHEET

Test Date 3-16-78 **Type Burner** MA-16 **Test Run #** 1/6

Burner ~~Gas~~ Tip Sizing Tip 764

Test No.	1/6-12	1/6-12	1/6-13	1/6-14	1/6-15
Time	10:20	11:05	11:25	12:25	12:45
GAS FIRING					
Burner Gas Pressure (psig)					
~~Gas Meter Flow (cfm)~~ ΔH "H₂O	-	-	2.15	2.05	1.45
~~Meter Pressure (psig)~~ Dist. In	-	-	4'	4'	4'
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75	75	75	75	75
Burner Steam Pressure (psig)	106	104	105	106	103
Oil Flow (gpm)	0.55	0.56	0.56	0.56	0.59
Steam Flow (lb/hr)	124	124	124	124	125
Type Oil	#6	#6	#6	#6	#6
Oil Temperature	310	310	310	305	305
Heat Release on Oil (MMBtu/hr)	4.77	4.91	4.9	4.9	5.09
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.07	-0.08	-0.05	-0.05	-0.05
Windbox Pressure					
O_2	3.5	2.6	3.2	1.1	1.3
Combustibles	0	0	0	0	0
Primary Air Door Opening	100	100	1 1/8"	1 1/4"	1 1/4"
Secondary Air Door Opening	100	100	5/8"	1/2"	1 5/16"
TEMPERATURE READINGS, °F					
T/C-2	1162	1287	1335	1464	1498
T/C-3	1247	1380	1418	1518	1545
T/C-4	1094	1207	1244	1366	1400
T/C-5	1034	1165	1218	1346	1381
T/C-6	992	1102	1144	1251	1286
T/C-7	1198	1313	1336	1448	1479
T/C-8	1106	1220	1243	1336	1368
T/C-9	997	1109	1146	1282	1263
T/C-10	1039	1149	1183	1273	1303
T/C-11	838	923	936	1003	1027
T/C-12					
Flame Length	5'	5'	6'-7'	6'-7'	7'
Flame Width	2'	2'	4'	≈4.5'	≈4.5'
Flame Characteristic	norm.	norm.	smoky clear stack	lazy →	lazy

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-16-78 **Type Burner** MA-16 **Test Run #** 1/6

Burner ~~Gas~~ Tip Sizing Tip 764

Test No.	1/6-16	1/6-17	1/6-18	1/6-19	
Time	16:40	17:20	17:45	18:05	
GAS FIRING					
Burner Gas Pressure (psig)					
~~Gas Meter Flow (cfm)~~ ΔH "H2O	1.55	1.55	2.1	-	
~~Meter Pressure (psig)~~ Dist. in	4'	4'	4'	-	
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75	75	75	75	
Burner Steam Pressure (psig)	105	105	105	105	
Oil Flow (gpm)	0.63	0.62	0.6	0.61	
Steam Flow (lb/hr)	125	128	128	132	
Type Oil	#6	#6	#6	#6	
Oil Temperature	247	252	255	255	
Heat Release on Oil (MMBtu/hr)	5.5	5.4	5.2	5.3	
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.12	-0.14	-0.07	-0.16	
Windbox Pressure					
O_2	3.6	4.0	4.0	3.4	
Combustibles	0	0	0	0	
Primary Air Door Opening	1½"	1½"	1½"	100%	
Secondary Air Door Opening	1½"	3/8"	1 5/8"	100%	
TEMPERATURE READINGS, °F					
T/C-2	1126	1293	1352	1408	
T/C-3	1066	1302	1325	1446	
T/C-4	1095	1247	1296	1351	
T/C-5	1054	1210	1263	1313	
T/C-6	1014	1150	1195	1244	
T/C-7	1237	1355	1403	1471	
T/C-8	1058	1217	1280	1351	
T/C-9	993	1131	1176	1225	
T/C-10	1045	1177	1221	1272	
T/C-11	805	918	955	1008	
T/C-12					
Flame Length	~7'	≈7'	≈7'	5'	
Flame Width	≈4.5'	≈4.5'	≈4.5'	2'	
Flame Characteristic	lazy	lazy	lazy	good	

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-21-78 Type Burner MA-16 Modif Test Run # 1/7

Burner Gas Tip Sizing Pattern II

Test No.	1/7-1	1/7-1	1/7-2	1/7-3	1/7-4
Time	9:50	10:20	11:00	12:40	13:00
GAS FIRING					
Burner Gas Pressure (psig)	15.0	14.8	15.0	15.8	15.9
Gas Meter Flow (cfm)	27.9	28.2	27.3	29.6	30.0
Meter Pressure (psig)	34.0	33.6	33.5	30.9	31
Meter Correction Factor	3.32	3.29	3.28	3.11	3.12
Heat Release on Gas (MMBtu/hr)	5.17	5.2	4.99	5.13	5.22
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
~~Oil Flow (gpm)~~ ΔP "H_2O	0.25	0.25	0.5	0.4	0.4
~~Steam Flow (lb/hr)~~ O_2 @ plenum	21	21	19.1	19.1	19.7
~~Type Oil~~ Temp. @ plenum	76	74	340	235	183
~~Oil Temperature~~ Fuel press. Aux. NH	0	0	2	1.8	1.1
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.08	-0.07	-0.12	-0.08	-0.06
Windbox Pressure					
O_2	3.0	3.3	3.6	3.1	3.0
Combustibles	0	0	0	0	0
Primary Air Door Opening	–	–	–	–	–
Secondary Air Door Opening	100	100	100	100	100
TEMPERATURE READINGS, °F					
T/C-2	977	1119	1293	1387	1559
T/C-3	1082	1240	1425	1459	1629
T/C-4	952	1068	1241	1461	1489
T/C-5	857	984	1186	1449	1473
T/C-6	803	929	1102	1340	1366
T/C-7	1062	1188	1407	1578	1596
T/C-8	939	1068	1259	1449	1450
T/C-9	804	933	1107	1189	1355
T/C-10	870	988	1159	1370	1394
T/C-11	689	801	921	1454	1484
T/C-12					
Flame Length	5'	6'	5'	5'	5'
Flame Width	2'	2'	2'	2'	2'
Flame Characteristic	clear →	→	→	→	→

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-2-78 **Type Burner** MA-16 Modif. **Test Run #** 1/7

Burner Gas Tip Sizing Pattern II

Test No.	1/7-5	1/7-6	1/7-7	1/7-8	1/7-9
Time	14:50	15:10	15:30	16:00	16:30
GAS FIRING					
Burner Gas Pressure (psig)	15.5	15.5	15.5	18.2	17.4
Gas Meter Flow (cfm)	28.17	28.3	28.57	30.3	30.93
Meter Pressure (psig)	30.2	30	29.7	30.5	32
Meter Correction Factor	3.06	3.05	3.03	3.05	312
Heat Release on Gas (MMBtu/hr)	4.81	4.82	4.83	5.22	5.38
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
~~Oil Flow (gpm)~~ ΔH "H_2O	0.55	0.65	0.6	0.65	0.4
~~Steam Flow (lb/hr)~~ O_2 @ Plenum	17.4	18.2	17.8	17.6	21
~~Type Oil~~ Temp. @ Plenum	418	411	407	415	75
~~Oil Temperature~~ Fuel Press. Aux. Htr	13	13	13	13	0
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.23	-0.2	-0.1	-0.07	-0.04
Windbox Pressure					
O_2	2.1	3.1	2.0	0.2	3.0
Combustibles	0	0	0	0	0
Primary Air Door Opening	-	-	-	-	-
Secondary Air Door Opening	100	100	100	100	100
TEMPERATURE READINGS, °F					
T/C-2	1388	1456	1497	1569	1631
T/C-3	1363	1437	1484	1600	1681
T/C-4	1366	1442	1486	1572	1625
T/C-5	1361	1429	1467	1543	1597
T/C-6	1281	1335	1342	1399	1457
T/C-7	1514	1577	1620	1719	1741
T/C-8	1302	1372	1419	1512	1584
T/C-9	1254	1316	1354	1428	1489
T/C-10	1309	1380	1418	1492	1541
T/C-11	1329	1397	1433	1506	1575
T/C-12					
Flame Length	5'	5'	5'	5'	5'
Flame Width	2'	2'	2'	2'	2'
Flame Characteristic	clear	→			

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-22-78 **Type Burner** MA-16 Modif **Test Run #** 1/7

Burner Gas Tip Sizing Tip 764

Test No.	1/7-10	1/7-10	1/7-11	1/7-12	1/7-13
Time	10:00	10:40	11:20	11:50	12:25
GAS FIRING					
~~Burner Gas Pressure (psig)~~ ΔH "H2O	0.2	0.2	0.5	0.62	0.7
~~Gas Meter Flow (cfm)~~ O2 @ Plenum	21	21	18.8	17.9	17.4
~~Meter Pressure (psig)~~ Temp. @ Plenum	80	80	354	349	417
~~Meter Correction Factor~~ Fuel Press. Aux. Htr.	0	0	3	9	14.5
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75	75	75	75	75
Burner Steam Pressure (psig)	105	105	105	105	104
Oil Flow (gpm)	0.57	0.58	0.57	0.57	0.58
Steam Flow (lb/hr)	124	125	124	125	123
Type Oil	#6	#6	#6	#6	#6
Oil Temperature	285	257	258	258	258
Heat Release on Oil (MMBtu/hr)	4.99	5.04	4.98	4.99	5.05
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.1	-0.1	-0.14	-0.08	-0.1
Windbox Pressure					
O_2	2.8 ÷ 3.2	2.95	3.15	3.0	2.9
Combustibles					
Primary Air Door Opening	-	-	-	-	-
Secondary Air Door Opening	100	100	100	100	100
TEMPERATURE READINGS, °F					
T/C-2	1350	1461	1508	1537	1568
T/C-3	1433	1529	1559	1574	1596
T/C-4	1316	1404	1442	1464	1501
T/C-5	1278	1379	1425	1452	1485
T/C-6	1171	1268	1323	1348	1382
T/C-7	1393	1490	1526	1538	1544
T/C-8	1263	1364	1407	1421	1456
T/C-9	1189	1278	1324	1353	1352
T/C-10	1224	1312	1355	1382	1412
T/C-11	1309	1402	1437	1459	1486
T/C-12					
Flame Length	6'	6'	6'	6'	7'
Flame Width	2'	2'	2.5'	3'	5'
Flame Characteristic	clear	clear	clear	clear	lazy

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 3-22-78 **Type Burner** MA-16 Modif. **Test Run #** 1/7

Burner ~~Gas~~ Tip Sizing Tip 764

Test No.	1/7-14	1/7-15	1/7-16	1/7-17	1/7-18
Time	12:40	13:00	13:30	15:00	15:30
GAS FIRING					
~~Burner Gas Pressure~~ ΔH" H_2O ~~(psig)~~	0.7	0.5	0.3	0.2	0.35
~~Gas Meter Flow (cfm)~~ O_2 @ Plenum	17.25	18.2	18.9	18.9	18.0
~~Meter Pressure (psig)~~ Temp. @ Plenum	420	314	216	191	323
~~Meter Correction Factor~~ Fuel Press. @ Atr. Mtr.	14	6	2	1.8	4.5
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	76	75	76	75	75
Burner Steam Pressure (psig)	104	104	106	105	105
Oil Flow (gpm)	0.6	0.6	0.57	0.57	0.58
Steam Flow (lb/hr)	123	123	123	123	123
Type Oil	#6	#6	#6	#6	#6
Oil Temperature	260	258	260	256	257
Heat Release on Oil (MMBtu/hr)	5.22	5.22	4.99	4.96	5.02
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.06	-0.1	-0.1	-0.16	-0.16
Windbox Pressure					
O_2	1.95	1.95	2.0	0.8	0.95
Combustibles	0	0	0	0	0
Primary Air Door Opening	–	–	–	–	–
Secondary Air Door Opening	100	100	100	100	100
TEMPERATURE READINGS, °F					
T/C-2	1585	1610	1637	1608	1646
T/C-3	1611	1632	1664	1620	1666
T/C-4	1520	1544	1581	1566	1605
T/C-5	1501	1522	1558	1544	1582
T/C-6	1400	1424	1450	1465	1491
T/C-7	1583	1613	1653	1639	1665
T/C-8	1478	1511	1540	1547	1571
T/C-9	1398	1423	1451	1449	1481
T/C-10	1426	1451	1476	1480	1513
T/C-11	1502	1522	1536	1529	1559
T/C-12					
Flame Length	≈7'	≈7'	≈7'	≈7'	≈7'
Flame Width	6'	5'	4'	5'	5.5'
Flame Characteristic	lazy	clear	clear	clear	lazy

COMMENTS:

KVB

TEST BURNER DATA SHEET

Test Date 3-22-78 **Type Burner** MA-16 Modif. **Test Run #** 1/7

Burner Gas Tip Sizing Tip 764

Test No.	1/7-19	1/7-20			
Time	15:50	16:45			
GAS FIRING					
~~Burner Gas Pressure (psig)~~ ΔP "H₂O	0.6	0.2			
~~Gas Meter Flow (scfm)~~ O₂ @ Plenum	17.0	21			
~~Meter Pressure (psig)~~ Temp. @ Plenum	411	88			
~~Meter Correction Factor~~ Fuel Press. @ Aux. Htr.	12.5	0			
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75	75			
Burner Steam Pressure (psig)	106	105			
Oil Flow (gpm)	0.57	0.58			
Steam Flow (lb/hr)	123	123			
Type Oil	#6	#6			
Oil Temperature	257	265			
Heat Release on Oil (MMBtu/hr)	4.94	5.04			
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.06	-0.11			
Windbox Pressure					
O_2	1.0	2.5			
Combustibles	0	0			
Primary Air Door Opening	-	-			
Secondary Air Door Opening	100	100			
TEMPERATURE READINGS, °F					
T/C-2	1653	1648			
T/C-3	1668	1661			
T/C-4	1602	1600			
T/C-5	1585	1580			
T/C-6	1485	1482			
T/C-7	1648	1652			
T/C-8	1579	1581			
T/C-9	1493	1495			
T/C-10	1516	1514			
T/C-11	1566	1565			
T/C-12					
Flame Length	27'	27'			
Flame Width	6'	3'			
Flame Characteristic	hazy	bright yellow			

COMMENTS:

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 4-26-78 **Type Burner** DBA-16 **Test Run #** 1/8-1

Burner Gas Tip Sizing PATTERN II (TIPS BACKWARDS)

Test No.	1/8-1	1/8-1	1/8-1	1/8-1	1/8-1
Time	1210	1330	1400	1420	1455
GAS FIRING					
Burner Gas Pressure (psig)	10.2	11.0	11.2	11.3	11.4
Gas Meter Flow (cfm)	10CF/21.2sec	10CF/21.1sec	10CF/21.0sec	10CF/20.8sec	10CF/20.8sec
Meter Pressure (psig)	31	31	31.4	31.5	31.6
Meter Correction Factor	3.12	3.12	3.15	3.15	3.16
Heat Release on Gas (MMBtu/hr)	4.93	4.95	5.02	5.07	5.09
OIL FIRING					
~~Burner Oil Pressure (psig)~~					
~~Burner Steam Pressure (psig)~~					
~~Oil Flow (gpm)~~					
~~Steam Flow (lb/hr)~~					
~~Type Oil~~					
~~Oil Temperature~~					
~~Heat Release on Oil (MMBtu/hr)~~					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.09	-0.08	-0.08	-0.08
~~Windbox Pressure~~ NO_x (ppm)	40	44	35	40	—
O_2 (%)	3.5-3.7	3.35	2.9	3.1	2.9-3.0
Combustibles	0	0	0	0	0
Primary Air Door Opening	100%	100%	100%	100%	100%
Secondary Air Door Opening	100%	100%	100%	100%	100%
TEMPERATURE READINGS, °F T/C-1	1591	1626	1721	1670(?)	1759
T/C-2	1447	1534	1582	1580	1622
T/C-3	1434	1530	1572	1574	1612
T/C-4	1305	1465	1506	1518	1522
T/C-5	1287	1451	1489	1501	1491
T/C-6	1261	1466	1502	1511	1431
T/C-7	1414	1515	1548	1556	1583
T/C-8	1319	1455	1490	1500	1472
T/C-9	1224	1417	1455	1467	1410
T/C-10	1253	1435	1475	1486	1441
T/C-11	1375	1466	1503	1513	1535
T/C-12	1439	1518	1548	1554	1574

Flame Length can't tell

Flame Width ~ 3'

Flame Characteristic some yellow areas above tile where fuel jets impinge; lazy flame — refractory red hot

COMMENTS: BASELINE BASELINE BASELINE BASELINE BASELINE

ZINK NO_x ANALYZER NOT CALIBRATED - DISREGARD NO_x READINGS

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date 4/26/78 **Type Burner** DBA-16 **Test Run #** 1/8-2 to 5

Burner Gas Tip Sizing PATTERN II (TIPS BACKWARDS)

Test No.	1/8-2	1/8-2	1/8-3	1/8-4	1/8-5
Time	1540	1640	1700	1720	1740
GAS FIRING					
Burner Gas Pressure (psig)	10.5	12.0	12.2	12.2	12.1
Gas Meter Flow (cfm)	10CF/21.0sec	10CF/20.2sec	10CF/20.0sec	10CF/20.0sec	10CF/20.2sec
Meter Pressure (psig)	29.8	30.5	31.2	31.0	31.2
Meter Correction Factor	3.04	3.09	3.13	3.12	3.13
Heat Release on Gas (MMBtu/hr)	4.85	5.12	5.24	5.22	5.19
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.04	-0.06	-0.05	-0.13	-0.10
Windbox Pressure					
O_2	1.0	1.1	0.2-0.4	4.3-4.5	2.9-3.2
Combustibles	0	0	0	0	0
Primary Air Door Opening	106%	100%	100%	100%	100%
Secondary Air Door Opening	100%	100%	100%	100%	100%
TEMPERATURE READINGS, °F T/C-1	1773	1801	1804	1812	1820
T/C-2	1689	1689	1704	1704	1699
T/C-3	1638	1679	1694	1690	1676
T/C-4	1551	1599	1614	1615	1616
T/C-5	1519	1561	1575	14[illegible]0	1579
T/C-6	1451	1497	1508	1513	1517
T/C-7	1616	1663	1683	1655	1659
T/C-8	1517	1583	1606	1596	1600
T/C-9	1446	1495	1513	1516	1516
T/C-10	1476	1526	1542	1541	1541
T/C-11	1558	1606	1620	1614	1614
T/C-12	1601	1648	1663	1644	1648
Flame Length					
Flame Width					
Flame Characteristic		lazy, more yellow		flame impinging on walls	
COMMENTS:	lower firing rate 1% O_2	1% O_2	CO limit	Still yellow region off tile High O_2	REPEAT BASELINE

Data Sheet 6015-20

KVB

MAY 2 1978

TEST BURNER DATA SHEET

Test Date ______ Type Burner DBA-16 Test Run # 1/8-6 to 9

Burner Gas Tip Sizing PATTERN II, TIPS BACKWARD (REPEAT OF PREVIOUS TEST)

Test No.	1/8-6	1/8-6	1/8-7	1/8-8	1/8-9
Time	1725	1740	1800	1825	1850
GAS FIRING					
Burner Gas Pressure (psig)	11.7	12.2	12.1	12.0	12.3
Gas Meter Flow (cfm)	10CF/20.6sec	10CF/20.5sec	10CF/20.4sec	10CF/21.3sec	10CF/20.4sec
Meter Pressure (psig)	31.2	31.0	30.6	32.2	30.6
Meter Correction Factor	3.13	3.12	3.09	3.20	3.09
Heat Release on Gas (MMBtu/hr)	5.09	5.10	5.07	5.03	5.07
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.12	-0.12	-0.08	-0.09	-0.13
Windbox Pressure					
O_2 (%)	3.3-3.5	2.8-3.1	0.3-0.5	1.5	4.3
Combustibles (%)	0	0	0.10-0.20	0	0
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
TEMPERATURE READINGS, °F T/C-1	1626	1631	1652	1671	1672
T/C-2	1568	1565	1581	1598	1596
T/C-3	1579	1576	1590	1606	1603
T/C-4	1523	1523	1533	1544	1540
T/C-5	1506	1505	1512	1519	1517
T/C-6	1430	1430	1448	1458	1461
T/C-7	1553	1553	1574	1582	1566
T/C-8	1476	1479	1503	1514	1509
T/C-9	1401	1401	1417	1433	1434
T/C-10	1432	1431	1447	1461	1460
T/C-11	1486	1486	1507	1520	1518
T/C-12	1516	1518	1543	1554	1547

Flame Length

Flame Width

Flame Characteristic

COMMENTS: TIPS BACKWARD →

BASELINE BASELINE O_2 SWING O_2 SWING O_2 SWING

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 2 1978 Type Burner DBA-16 Test Run # 1/8-10

Burner Gas Tip Sizing Pattern II, Tips Backward

Test No.	1/8-10				
Time	1910				
GAS FIRING					
Burner Gas Pressure (psig)	11.8				
Gas Meter Flow (cfm)	10 CF/20.7 sec				
Meter Pressure (psig)	30.5				
Meter Correction Factor	309				
Heat Release on Gas (MMBtu/hr)	5.00				
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.11				
Windbox Pressure					
O_2 (%)	3.0				
Combustibles (%)	0				
Primary Air Door Opening	100%				
Secondary Air Door Opening	100%				
TEMPERATURE READINGS, °F T/C-1	1680				
T/C-2	1599				
T/C-3	1604				
T/C-4	1544				
T/C-5	1517				
T/C-6	1464				
T/C-7	1574				
T/C-8	1516				
T/C-9	1438				
T/C-10	1464				
T/C-11	1521				
T/C-12	1552				

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

REPEAT
BASELINE

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date APR 2 7 1978 **Type Burner** DBA-16 **Test Run #** 1/9-1 to 1/9-2

Burner Gas Tip Sizing PATTERN II - TIPS NORMAL

Test No.	1/9-1	1/9-1	1/9-2	1/9-3	1/9-3
Time	1300	13:30	14:00	1500	1530
GAS FIRING					
Burner Gas Pressure (psig)	11.5	11.6	11.8	12.0	12.2
Gas Meter Flow (cfm)	10CF/20.4sec	10CF/20.1sec	10CF/20.9sec	10CF/20.0sec	10CF/19.9sec
Meter Pressure (psig)	30.8	31.5	31.7	30.9	30.9
Meter Correction Factor	3.11	3.15	3.17	3.12	3.12
Heat Release on Gas (MMBtu/hr)	5.10	5.25	5.08	5.22	5.25
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.09	-0.08	-0.08	-0.08	-0.08
~~Windbox Pressure~~ Steam Flow (#/hr)	—	—	53	54	53
O_2	2.9-3.2	3.0-3.2	2.9-3.3	2.5-2.9	3.1
Combustibles	0	0	0	0	0
Primary Air Door Opening	100%	100%			→
Secondary Air Door Opening	100%	100%			→
TEMPERATURE READINGS, °F T/C-1	1566	1601	1634	1661	1676
T/C-2	1567	1606	1635	1662	1677
T/C-3	1610	1647	1670	1690	1700
T/C-4	1504	1541	1569	1594	1608
T/C-5	1481	1521	1550	1579	1595
T/C-6	1417	1462	1489	1496	1506
T/C-7	1601	1635	1653	1681	1691
T/C-8	1518	1556	1543	1609	1625
T/C-9	1407	1446	1477	1511	1528
T/C-10	1427	1465	1502	1530	1547
T/C-11	1490	1529	1562	1589	1605
T/C-12	1564	1597	1622	1644	1657
Flame Length	>6'				
Flame Width	~1½'				
Flame Characteristic	long, narrow, uniform		Can't see any difference in flame		
COMMENTS:	difficult to see flame BASELINE	BASELINE	Oil Gun 8" below gas tips STEAM INJECTION THRU OIL GUN	Oil gun 4" below gas tips → Steam Press 8 Psig →	

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date APR 27 1978 **Type Burner** DBA-16 **Test Run #** 1/9-4 to 6

Burner Gas Tip Sizing PATTERN II - TIPS NORMAL

Test No.	1/9-4	1/9-5	1/9-6		
Time	1555	1615	1640		
GAS FIRING					
Burner Gas Pressure (psig)	12.4	12.5	12.4		
Gas Meter Flow (cfm)	10CF/20.0sec	10/19.9sec	10CF/19.8sec		
Meter Pressure (psig)	31.2	31.3	31.1		
Meter Correction Factor	3.13	3.14	3.12		
Heat Release on Gas (MMBtu/hr)	5.24	5.28	5.28		
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.09	-0.09	-0.09		
~~Windbox Pressure~~ Steam Flow (#/hr)	53	75	0		
O_2	2.9-3.1	2.9-3.1	2.8-3.0		
Combustibles	0	0	0		
Primary Air Door Opening	100%	→	→	→	→
Secondary Air Door Opening	100%	→	→	→	→
TEMPERATURE READINGS, °F	1694	1702	1713		
T/C-2	1695	1704	1715		
T/C-3	1715	1721	1731		
T/C-4	1627	1636	1649		
T/C-5	1612	1622	1633		
T/C-6	1518	1526	1536		
T/C-7	1719	1716	1730		
T/C-8	1644	1653	1668		
T/C-9	1646	1556	1568		
T/C-10	1584	1573	1585		
T/C-11	1619	1627	1637		
T/C-12	1670	1626	1687		

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

Oil gun 2" below gas tips →

STEAM INJECTION THRU OIL GUN → REPEAT BASELINE

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date APR 28 1978 Type Burner DBA-16 Test Run # 1/10-1 to 2

Burner Gas Tip Sizing PATTERN II

Test No.	1/10-1	1/10-1	1/10-1	1/10-2	1/10-2
Time	1110	1200	1225	1445	1510
GAS FIRING					
Burner Gas Pressure (psig)	11.9	11.2	11.2	12.4	11.3
Gas Meter Flow (cfm)	10CF/20.2 sec	10CF/20.2 sec	10CF/20.2 sec	10CF/19.9 sec	10CF/20.6
Meter Pressure (psig)	31.3	30.0	29.8	30.8	31.0
Meter Correction Factor	3.14	3.05	3.04	3.11	3.12
Heat Release on Gas (MMBtu/hr)	5.20	5.06	5.04	5.23	5.07
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.05	-0.05	-0.04	-0.09	-0.10
Windbox Pressure					
O_2 (%)	3.0	2.3-2.5	2.7-2.9	2.7-3.3	2.5-3.3
Combustibles (%)	0	0	0	0	0
Primary Air Door Opening	100%	→	→	→	→
Secondary Air Door Opening	100%	→	→	→	→
TEMPERATURE READINGS, °F T/C-1	1499	1557	1589	1736	1756
T/C-2	1525	1584	1614	1650	1684
T/C-3	1583	1636	1662	1682	1696
T/C-4	1457	1514	1542	1606	1623
T/C-5	1440	1501	1532	1582	1598
T/C-6	1364	1420	1446	1464	1473
T/C-7	1583	1623	1643	1653	1661
T/C-8	1490	1543	1568	1557	1565
T/C-9	1275	1284	1158	1176	1187
T/C-10	1404	1457	1483	1500	1511
T/C-11	1481	1526	1549	1535	1541
T/C-12	1554	1591	1611	1590	1596
Flame Length	~6'				
Flame Width	~2'				
Flame Characteristic	uniform looks good				

COMMENTS:

BASELINE - STAGING CYLINDER 3" Above tips →

BASELINE - STAGING CYL. 6" above tips →

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date APR 28 1978 Type Burner DBA-16 Test Run # 1/10-3

Burner Gas Tip Sizing

Test No.	1/10-3	1/10-3			
Time	1630	1655			
GAS FIRING					
Burner Gas Pressure (psig)	11.5	11.5			
Gas Meter Flow (cfm)	10CF/20.8 sec	10CF/20.8sec			
Meter Pressure (psig)	31.2	31.2			
Meter Correction Factor	3.13	3.13			
Heat Release on Gas (MMBtu/hr)	5.04	5.04			
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.09	-0.09			
Windbox Pressure					
O_2 (%)	2.6	2.9-3.1			
Combustibles (%)	0	0			
Primary Air Door Opening	100%	100%			
Secondary Air Door Opening	100%	100%			
TEMPERATURE READINGS, °F T/C-1	1678	1737			
T/C-2	1548	1599			
T/C-3	1554	1615			
T/C-4	1518	1567			
T/C-5	1489	1535			
T/C-6	1360	1405			
T/C-7	1562	1605			
T/C-8	1459	1502			
T/C-9	1093	1065			
T/C-10	1408	1451			
T/C-11	1420	1465			
T/C-12	1483	1529			

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

BASELINE
STAGING CYL.
9" ABOVE →
GAS TIPS

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 1 1978 **Type Burner** DBA-16 **Test Run #** 1/10-4 to 5

Burner Gas Tip Sizing PATTERN II

Test No.	1/10-4	1/10-4	1/10-4	1/10-4	1/10-5
Time	1105	1210	1320	1410	1600
GAS FIRING					
Burner Gas Pressure (psig)	12.0	12.0	11.5	12.1	12.7
Gas Meter Flow (cfm)	10CF/20.8sec	10CF/20.0sec			10CF/17.9 sec
Meter Pressure (psig)	32.2	30.3		29.7	29.0
Meter Correction Factor	3.20	3.07		3.03	2.99
Heat Release on Gas (MMBtu/hr)	5.15	5.14	5.11	~5.1	5.57
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.07	-0.06	-0.06	-0.06	-0.10
Windbox Pressure					
O_2 (%)	2.8	2.9	3.2 -3.7	3.0-3.4	2.9 - 3.0
Combustibles (%)	0	0		0	0
Primary Air Door Opening	100 %				→
Secondary Air Door Opening	100%				→
TEMPERATURE READINGS, °F T/C-1	1363	1492	1571	1608	1582
T/C-2	1241	1381	1468	1506	1462
T/C-3	1288	1420	1494	1525	1481
T/C-4	1129	1266	1366	1419	1420
T/C-5	1102	1259	1356	1402	1388
T/C-6	1025	1176	1271	1320	1295
T/C-7	1215	1345	1425	1465	1469
T/C-8	1134	1277	1352	1386	1360
T/C-9	971	929	1093	1134	—
T/C-10	1040	1179	1267	1314	1308
T/C-11	1166	1302	1378	1414	1370
T/C-12	1249	1354	1418	1451	1422
Flame Length	~6'				~6'
Flame Width	~2½'				~2½'
Flame Characteristic	cylinder glowing flame transparent				
COMMENTS:	BASELINE- STAGING CYL. 37" above gas tips	→	→	→	BASELINE- STAGING CYL. 43" above gas tips

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 1 1978 Type Burner DBA-16 Test Run # 1/10-5to8

Burner Gas Tip Sizing PATTERN II

Test No.	1/10-5	1/10-5	1/10-6	1/10-7	1/10-8
Time	1630	1650	1705	1730	1755
GAS FIRING					
Burner Gas Pressure (psig)	12.2	11.8	11.6	11.6	11.3
Gas Meter Flow (cfm)	10CF/18.6 sec	10CF/19.4 sec	10CF/19.8 sec	10CF/19.5 sec	10CF/19.8 sec
Meter Pressure (psig)	30.2	31.5	31.2	31.0	30.9
Meter Correction Factor	3.06	3.15	3.13	3.12	3.12
Heat Release on Gas (MMBtu/hr)	5.51	5.44	5.29	5.36	5.28
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.10	-0.12	-0.08	-0.07
Windbox Pressure					
O_2 (%)	2.4-3.5	3.0	4.8-5.2	1.1	0.1-0.5
Combustibles (%)	0	0	0	0	0.25
Primary Air Door Opening	100% →				
Secondary Air Door Opening	100% →				
TEMPERATURE READINGS, °F T/C-1	1611	1626	1630	1653	1664
T/C-2	1487	1505	1513	1528	1545
T/C-3	1513	1532	1539	1557	1575
T/C-4	1452	1473	1479	1502	1522
T/C-5	1419	1440	1448	1447	1487
T/C-6	1319	1337	1346	1362	1379
T/C-7	1497	1510	1507	1536	1553
T/C-8	1382	1400	1406	1426	1440
T/C-9	—	—	—	—	
T/C-10	1336	1355	1363	1383	1401
T/C-11	1392	1407	1414	1428	1441
T/C-12	1445	1459	1462	1480	1492

Flame Length

Flame Width

Flame Characteristic flame difficult to see →
cylinder red hot

COMMENTS: BASELINE- STAGING CYL 43" ABOVE GAS TIPS → O_2 SWING STAGING CYL 43" ABOVE GAS TIPS →

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 1 1978 **Type Burner** DBA-16 **Test Run #** 1/10-8 to 9

Burner Gas Tip Sizing BATT. II

Test No.	1/10-8	1/10-9	1/10-9		
Time	1805	1825	1840		
GAS FIRING					
Burner Gas Pressure (psig)	11.3	11.6	11.3		
Gas Meter Flow (cfm)	10CF/19.9 sec	10CF/19.6 sec	10CF/19.8 sec		
Meter Pressure (psig)	30.9	31.1	31.2		
Meter Correction Factor	3.12	3.12	3.13		
Heat Release on Gas (MMBtu/hr)	5.25	5.33	5.29		
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.07	-0.09	-0.09		
Windbox Pressure					
O_2 (%)	0.2-0.4	2.5-2.7	2.8-3.0		
Combustibles (%)	0.05	6	0		
Primary Air Door Opening	100%	100%	100%		
Secondary Air Door Opening	100%	100%	100%		
TEMPERATURE READINGS, °F T/C-1	1672	1680	1682		
T/C-2	1552	1558	1562		
T/C-3	1583	1588	1590		
T/C-4	1531	1535	1538		
T/C-5	1497	1503	1507		
T/C-6	1386	1393	1398		
T/C-7	1561	1558	1560		
T/C-8	1446	1450	1451		
T/C-9	—	—	—		
T/C-10	1410	1415	1418		
T/C-11	1448	1451	1452		
T/C-12	1500	1501	1502		

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

O_2 SWING
STAGING CYL
43" ABOVE
GAS TIPS

REPEAT BASELINE →

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 2 1978 **Type Burner** DBA-16 **Test Run #** 1/11-1

Burner Gas Tip Sizing PATTERN II

Test No.	1/11-1	1/11-1	1/11-1	1/11-1	1/11-1
Time	0830	0900	0930	1000	1125
GAS FIRING					
Burner Gas Pressure (psig)	9.3	9.7	11.3	11.2	11.6
Gas Meter Flow (cfm)	10CF/24.7 sec	10CF/26.3 sec	10cf/22.5	10 cf / 23.0	10CF/23.5 sec
Meter Pressure (psig)	39.5	39.9	38.0	35.8	38.0
Meter Correction Factor	3.70	3.73	3.59	3.44	3.59
Heat Release on Gas (MMBtu/hr)	5.02	4.75	5.11	5.07	5.11
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.11	-0.11	-0.11	-0.12	-0.12
Windbox Pressure					
O_2 (%)	3.4-3.5	2.9-3.0	2.9-3.1	2.6	3.1-3.3
Combustibles (%)	0	0	0	0	0
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
TEMPERATURE READINGS, °F T/C-1	834	982	1108	1186	1361
T/C-2	813	979	1119	1208	1372
T/C-3	880	1077	1224	1307	1435
T/C-4	778	924	1044	1119	1254
T/C-5	674	833	974	1071	1266
T/C-6	653	802	938	1027	1207
T/C-7	924	1067	1198	1266	1411
T/C-8	832	955	1101	1195	1341
T/C-9	656	803	941	1028	1197
T/C-10	729	869	1001	1084	1242
T/C-11	825	788	1129	1210	1341
T/C-12	995	1112	1223	1287	1399
Flame Length	~6'				
Flame Width	~2'				
Flame Characteristic	uniform blue-pits				
COMMENTS:	about 2' above tile HEAT-UP → BASELINE				START

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 8 1978 **Type Burner** DBA-16 **Test Run #** 1/11-1 to 2

Burner Gas Tip Sizing PATTERN II, TIPS NORMAL

Test No.	1/11-1	1/11-1	1/11-1	1/11-1	1/11-2
Time	1155	1220	1305	1325	1400
GAS FIRING					
Burner Gas Pressure (psig)	11.6	11.7	11.8	11.8	11.9
Gas Meter Flow (cfm)	10CF/23.5sec	10CF/23.5sec	10CF/22.5sec	10CF/22.5sec	10CF/23.0sec
Meter Pressure (psig)	37.8	38.0	36.0	36.0	37.0
Meter Correction Factor	3.58	3.59	3.46	3.46	3.53
Heat Release on Gas (MMBtu/hr)	5.10	5.11	5.15	5.15	5.14
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.12	-0.12	-0.12	-0.12	-0.10
Windbox Pressure					
O_2 (%)	3.2-3.3	3.1	3.0	3.0	1.0-1.2
Combustibles (%)	0	0	0	0	0
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
TEMPERATURE READINGS, °F T/C-1	1398	1434	1483	1501	1545
T/C-2	1409	1443	1489	1505	1542
T/C-3	1462	1490	1526	1539	1570
T/C-4	1288	1326	1386	1409	1456
T/C-5	1312	1352	1406	1424	1462
T/C-6	1246	1284	1335	1352	1391
T/C-7	1441	1473	1510	1524	1563
T/C-8	1362	1388	1419	1429	1466
T/C-9	1236	1269	1316	1333	1369
T/C-10	1278	1311	1357	1372	1408
T/C-11	1368	1397	1435	1447	1481
T/C-12	1419	1445	1482	1492	1528

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

HEAT-UP BASELINE	HEAT-UP BASELINE	High Moist. → (Leak in hot line) Bad hot data BASELINE	BASELINE	1% O_2 O_2 SWING

Data Sheet 6015-20

KVB

MAY 2 1978

MAY 8 1978

TEST BURNER DATA SHEET

Test Date_____ Type Burner DBA-16 Test Run # 1/11-2 to 5

Burner Gas Tip Sizing PATTERN II

Test No.	1/11-2	1/11-3	1/11-4	1/11-5	
Time	1420	1435	1445	1540	
GAS FIRING					
Burner Gas Pressure (psig)	11.9	11.8	11.1	12.3	
Gas Meter Flow (cfm)	10/23.3 sec	10/23.0 sec	10CF/22.0 sec	10CF/22.1 sec	
Meter Pressure (psig)	37.0	37.0	36.2	35.0	
Meter Correction Factor	3.53	3.53	3.47	3.39	
Heat Release on Gas (MMBtu/hr)	5.07	5.14	4.86	5.14	
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.10	-0.12	-0.08	-0.12	
Windbox Pressure					
O_2 (%)	0.9-1.4	0.4-2.5	0.3-6.4	3.9-3.2	
Combustibles (%)	0	0	0.10	0	
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
TEMPERATURE READINGS, °F T/C-1	1558	1559	1584	1583	
T/C-2	1554	1560	1576	1577	
T/C-3	1580	1583	1592	1592	
T/C-4	1472	1479	1503	1509	
T/C-5	1475	1483	1500	1505	
T/C-6	1404	1410	1428	1433	
T/C-7	1573	1566	1583	1586	
T/C-8	1475	1471	1487	1487	
T/C-9	1381	1389	1405	1411	
T/C-10	1421	1428	1446	1450	
T/C-11	1492	1495	1506	1506	
T/C-12	1538	1535	1546	1547	
Flame Length					
Flame Width					
Flame Characteristic					
COMMENTS:	O_2 swing 1% O_2	O_2 SWING 4.5% O_2	O_2 SWING 0.3% O_2	REPEAT BASELINE	

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 3 1978 Type Burner TERTIARY AIR Test Run # 1/12-1 to 3

MODIFIED SECONDARY TILE

Burner Gas Tip Sizing PATTERN IIC

Test No.	1/12-1	1/12-1	1/12-1	1/12-2	1/12-3
Time	1330	1405	1520	1605	1630
GAS FIRING					
Burner Gas Pressure (psig)	4.7	4.8	4.7	4.8	5.0
Gas Meter Flow (cfm)	10CF/25.3sec	10CF/25.3sec	10CF/23.0sec	10CF/23.9sec	10CF/23.8sec
Meter Pressure (psig)	43.0	43.7	39.0	39.9	40.5
Meter Correction Factor	3.93	3.97	3.66	3.73	3.76
Heat Release on Gas (MMBtu/hr)	5.20	5.25	5.33	5.23	5.29
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.19	-0.19	-0.19	-0.15	-0.15
Windbox Pressure					
O_2 (%)	2.8-3.0	2.7	3.1	0.6-0.8	0.1
Combustibles (%)	0	0	0	0	0.05
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
Tertiary " " "	100%				→
TEMPERATURE READINGS, °F T/C-1	1263	1330	1433	1495	1517
T/C-2	1303	1369	1469	1527	1554
T/C-3	1440	1491	1554	1602	1620
T/C-4	1277	1332	1434	1499	1524
T/C-5	1263	1337	1443	1495	1517
T/C-6	1179	1249	1349	1399	1420
T/C-7	1417	1474	1550	1595	1618
T/C-8	1355	1397	1441	1477	1492
T/C-9	697	—	—	—	—
T/C-10	1235	1292	1381	1427	1450
T/C-11	1152	1400	1465	1506	1523
T/C-12	1414	1455	1512	1551	1567
Flame Length	~10'				~10'
Flame Width	~2½'				~2½'
Flame Characteristic	Yellow flame				
COMMENTS:	BASELINE	BASELINE	BASELINE	O_2 SWING	O_2 SWING

Data Sheet 6015-20

KVB

TEST BURNER DATA SHEET

Test Date MAY 3 1978 **Type Burner** TERTIARY AIR MODIFIED SECONDARY TILE **Test Run #** 1/12-4+5

Burner Gas Tip Sizing PATTERN II C

Test No.	1/12-4	1/12-4	1/12-5		
Time	1725	1735	1750		
GAS FIRING					
Burner Gas Pressure (psig)	4.8	4.9	4.9		
Gas Meter Flow (cfm)	10CF/24.3sec	10CF/24.1sec	10CF/24.3sec		
Meter Pressure (psig)	40.5	40.4	40.4		
Meter Correction Factor	3.76	3.76	3.76		
Heat Release on Gas (MMBtu/hr)	5.18	5.22	5.18		
OIL FIRING					
Burner Oil Pressure (psig)					
Burner Steam Pressure (psig)					
Oil Flow (gpm)					
Steam Flow (lb/hr)					
Type Oil					
Oil Temperature					
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.19	-0.19	-0.20		
Windbox Pressure					
O_2 (%)	3.0-3.1	2.9-3.1	4.2		
Combustibles (%)	0	0	0		
Primary Air Door Opening	100%				
Secondary Air Door Opening	100%				
Tertiary " " "	100%				
TEMPERATURE READINGS, °F T/C-1	1537	1539	1540		
T/C-2	1574	1577	1580		
T/C-3	1626	1627	1626		
T/C-4	1551	1555	1557		
T/C-5	1544	1548	1551		
T/C-6	1944	1451	1456		
T/C-7	1627	1628	1627		
T/C-8	1513	1518	1523		
T/C-9	—	—	—		
T/C-10	1479	1483	1487		
T/C-11	1538	1540	1540		
T/C-12	1577	1577	1577		

Flame Length

Flame Width

Flame Characteristic

COMMENTS:

O₂ SWING O₂ SWING O₂ SWING

KVB

TEST BURNER DATA SHEET

Test Date MAY 4 1978 Type Burner TERTIARY AIR Test Run # 1/12-6

MODIFIED SECONDARY TILE

Burner Gas Tip Sizing TIP 784

Test No.	1/12-6	1/12-6	1/12-6	1/12-6	1/12-6
Time	1025	1320	1430	1500	1520
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	80	75	75	75	75
Burner Steam Pressure (psig)	110	105	105	107	106
Oil Flow (gpm) (?)	0.5gal/41.5sec	0.5/43.7sec	0.5/43.7sec	0.5/43.5	0.5/43.7 (?)
Steam Flow (lb/hr)	120	115	120	119	120
Type Oil	NO. 6	NO.6	NO.6	NO.6	NO.6
Oil Temperature (°F)	275	275	273	272	271
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.23	-0.21	-0.21	-0.20	-0.22
Windbox Pressure					
O_2 (%)	2.9	2.9-3.0	3.0-3.4	2.6-3.1	2.8-3.2
Combustibles (%)	0	0	0	0	0
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
Tertiary " " "	100%				→
TEMPERATURE READINGS, °F T/C-1	1493	1524	1613	1635	1639
T/C-2	1433	1463	1536	1555	1561
T/C-3	1450	1476	1556	1572	1575
T/C-4	1426	1457	1532	1550	1554
T/C-5	1405	1442	1516	1534	1540
T/C-6	1344	1385	1458	1471	1468
T/C-7	1543	1559	1624	1641	1643
T/C-8	1468	1489	1553	1570	1575
T/C-9	—	—	—	—	—
T/C-10	1385	1419	1489	1504	1512
T/C-11	1436	1465	1532	1545	1550
T/C-12	1500	1521	1585	1597	1602
Flame Length	~10'				
Flame Width	~2'				
Flame Characteristic	good, but may be impinging				
COMMENTS:	on top of secondary tile				
	BASELINE	BASELINE	BASELINE	BASELINE	BASELINE

OIL FLOWMETER ERRATIC Data Sheet 6015-20

KVB

MAY 4 1978

TEST BURNER DATA SHEET

Test Date ______ Type Burner TERTIARY AIR Test Run # 1/12-7 to 10

Burner Gas Tip Sizing TIP 784

Test No.	1/12-7	1/12-8	1/12-8	1/12-9	1/12-10
Time	1540	1605	1625	1655	1715
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75	75	75	75	75
Burner Steam Pressure (psig)	104	103.5	104	104	103
Oil Flow (gpm) (?)	0.594/42.55	0.5/42.3	0.5/42.9	0.5/42.5	0.5 / 42.5 (?)
Steam Flow (lb/hr)	120	120	119	119	110
Type Oil	NO.6	NO.6	NO.6	NO.6	NO.6
Oil Temperature	270	270	270	270	270
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.16	-0.14	-0.14	-0.20	-0.25
Windbox Pressure					
O_2 (%)	0.7-0.9	0.1-0.2	0.2	2.9-3.2	4.2-4.5
Combustibles (%)	0	0.05	0.05	0	0
Primary Air Door Opening	100%				→
Secondary Air Door Opening	100%				→
Tertiary " " "	100%				→
TEMPERATURE READINGS, °F T/C-1	1656	1679	1700	1688	1680
T/C-2	1571	1588	1605	1601	1595
T/C-3	1586	1611	1637	1625	1610
T/C-4	1568	1587	1605	1599	1593
T/C-5	1552	1566	1582	1584	1581
T/C-6	1479	1489	1500	1501	1497
T/C-7	1656	1671	1676	1667	1666
T/C-8	1585	1593	1595	1597	1593
T/C-9	—	—	—	—	—
T/C-10	1521	1531	1538	1544	1544
T/C-11	1559	1568	1570	1576	1574
T/C-12	1610	1616	1615	1624	1623
Flame Length					
Flame Width					
Flame Characteristic		Smoky at edges			
COMMENTS:	O_2 SWING 1% O_2	O_2 SWING CO limit	O_2 SWING CO limit	O_2 SWING 3% O_2	O_2 SWING High O_2

SUSPECT OIL FLOWMETER

KVB

TEST BURNER DATA SHEET

Test Date MAY 4 1978 Type Burner TERTIARY AIR MOD. SEC. TILE Test Run # 1/12-10

Burner Gas Tip Sizing TIP 784

Test No.	1/12-10				
Time	1730				
GAS FIRING					
Burner Gas Pressure (psig)					
Gas Meter Flow (cfm)					
Meter Pressure (psig)					
Meter Correction Factor					
Heat Release on Gas (MMBtu/hr)					
OIL FIRING					
Burner Oil Pressure (psig)	75				
Burner Steam Pressure (psig)	102				
Oil Flow (gpm)	0.5/42.5				
Steam Flow (lb/hr)	117				
Type Oil	NO.6				
Oil Temperature	270				
Heat Release on Oil (MMBtu/hr)					
AIR INFORMATION					
Furnace Draft (in. H_2O)	-0.24				
Windbox Pressure					
O_2 (%)	3.8-4.4				
Combustibles (%)	0				
Primary Air Door Opening	100%				
Secondary Air Door Opening	100%				
Tertiary " " "	100%				
TEMPERATURE READINGS, °F T/C-1	1675				
T/C-2	1590				
T/C-3	1597				
T/C-4	1590				
T/C-5	1579				
T/C-6	1500				
T/C-7	1662				
T/C-8	1543				
T/C-9	—				
T/C-10	1545				
T/C-11	1575				
T/C-12	1621				
Flame Length	≥10'				
Flame Width	~2'				
Flame Characteristic					

COMMENTS:

O_2 SWING

Data Sheet 6015-20

FUEL OIL AND NATURAL GAS ANALYSES

Fuel Oil

	1 No. 6 Oil, 1/18/78 Test 1/1-7	2 No. 2 Oil, 1/20/78 Test 1/1-10
Ultimate Analysis:		
Carbon, %	86.29	86.36
Hydrogen, %	10.07	13.48
Nitrogen, %	0.31	0.012
Sulfur, %	2.14	0.11
Ash, %	0.042	0.001
Oxygen, % (by difference)	1.15	0.04
API Gravity at 60 °F	11.4	38.7
Heat of Combustion:		
Gross, kJ/kg (Btu/lb)	42 082 (18,090)	45 688 (19,640)
Net, kJ/kg (Btu/lb)	39 942 (17,170)	42 827 (18,410)

Natural Gas

Component	Mol %
Helium	0.04
Nitrogen	2.23
Carbon Dioxide	0.53
Methane	92.14
Ethane	3.96
Propane	0.60
Iso-Butane	0.06
N-Butane	0.10
Iso-Pentane	0.03
N-Pentane	0.03
Hexane	0.03
Oxygen	0.25
Heating Value, dry, Gross, J/m^3 (Btu/CF)	38.18×10^6 (1025)
Specific Gravity of Gas (relative to air)	0.5987

Fuel Oil

	No. 6 Oil, 2/23/78	Shale Oil, 2/22/78
Carbon, %	85.98	83.96
Hydrogen, %	10.33	11.17
Nitrogen, %	0.31	2.10
Sulfur, %	2.18	0.52
Ash, %	0.042	0.051
Oxygen, % (by difference)	1.16	2.20
API Gravity at 60 °F	12.4	20.3
Heat of Combustion:		
Gross, kJ/kg (Btu/lb)	40 763 (18,190)	40 851 (18,270)
Net, kJ/kg (Btu/lb)	38 571 (17,250)	38 571 (17,250)

(continued)

Fuel Analyses

FUEL ANALYSES (CONTINUED)

Fuel Oil

	No. 6 Oil, 3/23/78
Carbon, %	85.37
Hydrogen, %	10.54
Nitrogen, %	0.28
Sulfur, %	1.87
Ash, %	0.037
Oxygen, % (by difference)	1.90
API Gravity at 60 °F	13.7
Heat of Combustion:	
Gross, kJ/kg (Btu/lb)	40 606 (18,120)
Net, kJ/kg (Btu/lb)	38 455 (17,160)

Fuel Oil

	No. 6 Oil, 5/4/78
Carbon, %	86.57
Hydrogen, %	10.62
Nitrogen, %	0.29
Sulfur, %	1.92
Ash, %	0.037
Oxygen, % (by difference)	0.56
PI Gravity at 60 °F	13.5
eat of Combustion:	
Gross, kJ/kg (Btu/lb)	42 594 (18,310)
Net, kJ/kg (Btu/lb)	40 338 (17,340)

LOCATION 7 - REFINERY PROCESS HEATER

SET 1, JUNE 11 - JULY 21, 1980

PETROLEUM PROCESS HEATER

Location No. 7 **Unit No.** 11H13

Unit Description
- CRUDE OIL HEATER
- VERTICAL CYLINDRICAL
- NATURAL DRAFT
- 6 BURNERS

Installation Date 1974

Heater Rating 107.65 m³/h (16,250 bbl/d)

Burner Description (6) JOHN ZINK DBA-22 NATURAL DRAFT BURNERS

Test Fuel Combinations NATURAL GAS, REFINERY GAS, NATURAL GAS + REFINERY GAS, NATURAL GAS + No. 6 OIL, REFINERY GAS + No. 6 OIL

Fuel Temp. at Burner (°F) GASEOUS FUELS = AMBIENT, NO. 6 OIL = 200°F

Primary Air Temp. (°F) AMBIENT

Comments:

MOBILE LABORATORY DATA

Test No.________

Test No. 7/1-1 Date 6-11-80 Location 7/1-1 Engr. TIBONE / HAET

Unit No. 11H13 Fuel ~~Refinery~~ Natural Gas Capacity ~~18,000~~ 16,250 BBL/DAY

Unit Type CRude HEATER Burner Type JOHN ZINK DBA-2.

BASELINE ——→ DATA: J. Pionessa

1. Test No.	7/1-1		7/1-1		7/1-1		7/1-1		7/1-2	
2. Date	6-11-90		6-11-90		———		———		——→	
3. Time	10:33 am		11:09 am		11:47 am		13:06		14:30	
4. Load										
5. Process Rate BBL/DAY X10^3	11.27		11.27		11.27		11.27		11.27	
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER 25"		CENTER		CENTER		CENTER		CENTER	
8. Oxygen (%)	3.94		3.85		3.85		4.1		2.0	
9. NOx (hot) read/3% O2 (ppm)* WET	64	92	62	91	61	92	65	95	65	86
10. NO (hot) read/3% O2 (ppm)* WET	64	92	62	91	61	92	65	95	65	86
11. NO2 (hot) read/3% O2 (ppm)* WET	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O2 (ppm)* DRY	87	92	87	91	89	92	90	95	92	86
13. Carbon Dioxide (%)	9.0		9.0		8.9		9.6		11.0	
14. Carbon Monoxide (ppm) DRY uncor/cor*	40	42	40	42	40	42	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	5	6	5	6
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	76.5°F		81°F		82°F		89°F		88°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.14		30.14		30.14		30.14		30.14	
21. Relative Humidity (%)	36%		32%		32%		37%		36%	
22.										
23.										
24.										
25.									OPTIMUM	
26.									LOW	
27.									O_2	
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

P.G 2 oF 2

MOBILE LABORATORY DATA

Test No. ______

Test No. 7/1-3 Date 6-11-80 Location 7/1-1 - 7/1-2 Engr. TiDona / HART

Unit No. 11N13 Fuel Natural Gas Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type John Zink DBA-2

DATA BY J. FRANCESSA

1. Test No.	7/1-3		7/1-3				
2. Date	6-11-80		6-11-80				
3. Time	15.33		16:32				
4. Load							
5. Process Rate BBL/DAY X10^3							
6. Flue Diam. or Size, ft							
7. Probe Position	25" CENTER		CENTER				
8. Oxygen (%)	.05		5.6				
9. NOx (hot) read/3% O_2 (ppm)* WET			60	102			
10. NO (hot) read/3% O_2 (ppm)* WET	.05		60	102			
11. NO_2 (hot) read/3% O_2 (ppm)* WET			0	0			
12. NO (cold) read/3% O_2 (ppm)* DRY	78		87	102			
13. Carbon Dioxide (%)	10.5		8.6				
14. Carbon Monoxide (ppm) uncor/cor*			0	0			
15. Hydrocarbon (ppm) uncor/cor*			0	0			
16. Sulfur Dioxide (ppm) uncor/cor*			0	0			
17. Smoke Spot (Bacharach)							
18. Atmos. Temp. (°F/°C)			90°F				
19. Dew Point Temp. (°F/°C)							
20. Atmos. Pressure (in. Hg)	DATA NO GOOD		30.064				
21. Relative Humidity (%)			40%				
22.							
23.							
24.							
25.			HIGH				
26.			O_2				
27.							
28.							
29.							
30.							

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No._______

Test No. 7/1-1, 4 Date 6-12-80 Location 7 Engr. [illegible]

Unit No. 11 [illegible] Fuel N. GAS Capacity ~~48,000~~ 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type John Zink DBA-22

BASELINE CO LIMIT

1. Test No.	7/1-1		7/1-4							
2. Date	6-12		6-12							
3. Time	9:58		11:50							
4. Load			MED							
5. Process Rate (bbl/day)	11.27		11.27							
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER 25%		CENTER							
8. Oxygen (%)	3.98		0.9							
9. NOx (hot) read/3% O_2 (ppm)* WET	60	87	52	64						
10. NO (hot) read/3% O_2 (ppm)* WET	60	87	52	64						
11. NO_2 (hot) read/3% O_2 (ppm)* WET	0	0	0	0						
12. NO (cold) read/3% O_2 (ppm)* DRY	82	87	72	64						
13. Carbon Dioxide (%)	8.8		12.0							
14. Carbon Monoxide (ppm) uncor/cor*	20	21	0	0						
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0						
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0						
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	73°F		71°F							
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.24		30.24							
21. Relative Humidity (%)	55%		60%							
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/2-1

Test No. 7/2-1 Date 6-12-80 Location 7 Engr. Tagin/[illegible]

Unit No. A H13 Fuel N. GAS Capacity ~~18,000~~ 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type John Zink DBA-22

HIGH LOAD

1. Test No.	7/2-1		7/2-1		7/2-1		7/2-2			
2. Date	6-12-80		6-12-80		6-12-80		6-12-80			
3. Time	15:00		15:39		16:22		17:00			
4. Load										
5. Process Rate (bbl/day)	14000		14000		14000		14000			
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER 35'		CENTER		CENTER		CENTER			
8. Oxygen (%)	3.4		3.2		3.25		4.2			
9. NOx (hot) read/3% O$_2$ (ppm)* WET	58	83	60	81	60	81	56	84		
10. NO (hot) read/3% O$_2$ (ppm)* WET	58	83	60	81	60	81	56	84		
11. NO$_2$ (hot) read/3% O$_2$ (ppm)* WET	0	0	0	0	0	0	0	0		
12. NO (cold) read/3% O$_2$ (ppm)* DRY	81	83	80	81	80	81	78	84		
13. Carbon Dioxide (%)	9.8		9.6		9.6		9.4			
14. Carbon Monoxide (ppm) uncor/cor*	20	24	20	23	30	35	0	0		
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	77°F		80°F		80°F		79			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.20		30.20↓		30.16↓		30.14			
21. Relative Humidity (%)	56%		51%		55%		45			
22.										
23.										
24.	Baseline →						High O$_2$			
25.	low O$_2$ →						Baseline			
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O$_2$ should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/2-2→4 Date 6/13/80 Location 7 Engr. TIDONA/HART

Unit No. 11 H13 Fuel NG Capacity ~~18,000~~ 16,250 BBL/DAY

Unit Type CRUDE HTR Burner Type ZINK PBA-22..

1. Test No.	7/2-2		7/2-3		7/2-4			
2. Date	6-13-80		→					
3. Time	09:45		10:49		11:12			
4. Load								
5. Process Rate (bbl/day)	14.2 K		→					
6. Flue Diam. or Size, ft								
7. Probe Position	CNTR		→					
8. Oxygen (%)	4.1		1.9		4.5			
9. NOx (hot) read/3% O2 (ppm)*	55	80	45	69	45	83		
10. NO (hot) read/3% O2 (ppm)*	55	80	45	69	45	83		
11. NO2 (hot) read/3% O2 (ppm)*	0	0	0	0	0	0		
12. NO (cold) read/3% O2 (ppm)*	75	80	73	69	76	83		
13. Carbon Dioxide (%)	9.2		11.0		9.5			
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0		
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0		
17. Smoke Spot (Bacharach)								
18. Atmos. Temp. (°F/°C)	72		72		73			
19. Dew Point Temp. (°F/°C)								
20. Atmos. Pressure (in. Hg)	30.16		30.16		30.16			
21. Relative Humidity (%)	54		56		58			
22.								
23. COND. —	BASELINE		LO - O2		HI - O2			
24.								
25.							LOAD	
26.							CHNG.	
27.								
28.								
29.								
30.								

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/3

Test No. 7/3-1 To Date 6-13-90 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Nat. Gas Capacity 16250 ~~[illegible]~~ bbl/d

Unit Type Crude process heater Burner Type Zink DBA-22

1. Test No.	7/3-1		7/3-2		7/3-3		7/3-4			
2. Date	6-13		→							
3. Time	14:19		15:03		1537		16:35			
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CNTR		→							
8. Oxygen (%)	8.7		5.6		4.2		2.3			
9. NOx (hot) read/3% O_2 (ppm)*	45	92	49	94	52	87	53	58		
10. NO (hot) read/3% O_2 (ppm)*	45	92	49	94	52	87	53	58		
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0		
12. NO (cold) read/3% O_2 (ppm)*	63	92	80	94	81	87	60	58		
13. Carbon Dioxide (%)	5.8		8.3		9.2		9.9			
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	71		75		77		82			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.10		30.08		30.06		30.06			
21. Relative Humidity (%)	66		64		60		50			
22. COND.	BASELINE		MID - O_2		LO - O_2		LO O_2			
23.	LO - LOAD		LO - LOAD		→					
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/4-1 Date 6-16-80 Location 7 Engr. TIDONA/HIFET

Unit No. 11 H13 Fuel OIL Capacity ~~18,000~~ 16,250 BBL/DAY

Unit Type CRUDE HEATR Burner Type JOHN ZINK DBA-22.

BASELINE

1. Test No.	7/4-1		7/4-1		7/4-2		7/4-3		7/4-4	
2. Date	6-16-80		6-16-80		6-16-80		6-17-80		6-17-80	
3. Time	14:28		16:00		16:57		11:10		12:32	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER 28"		CENTER							
8. Oxygen (%)	4.2		4.3		5.7		3.8		2.2	
9. NOx (hot) read/3% O_2 (ppm)* WET	146	222	140	208	140	224	135	188	120	153
10. NO (hot) read/3% O_2 (ppm)* WET	146	222	140	208	140	224	135	188	120	153
11. NO_2 (hot) read/3% O_2 (ppm)* WET	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)* DRY	207	222	193	208	190	224	180	188	160	153
13. Carbon Dioxide (%) CO_2	11.8		~~9.0~~ ?		9.8		12.8		16.8	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) SO_2 uncor/cor*	780	963	560	696	860	1166	70	84	70	77
17. Smoke Spot (Bacharach)	2.5		1.0		1.0		2.0		6.5	
18. Atmos. Temp. (°F/°C)	94		94		93		83°F		87°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.04		30.00		30.00		30.00		30.00	
21. Relative Humidity (%)	44*		30		36%		56%		56%	
22. POSSIBLE CONTAMINATION *										
23.										
24. COND.	BASELINE		BASELINE		HIGH O_2		BASELINE CHECK		MED 200 O_2	
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. Date 6-17-80 Location 7 Engr. TODDARO/HART

Unit No. 11 H13 Fuel OIL Capacity ~~18,000~~ 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

1. Test No.	7/4-5		-			
2. Date	6-17-80					
3. Time	13:58					
4. Load						
5. Process Rate						
6. Flue Diam. or Size, ft						
7. Probe Position	25" CENTER					
8. Oxygen (%)	0.9-1.6					
9. NOx (hot) read/3% O_2 (ppm)*	102	120				
10. NO (hot) read/3% O_2 (ppm)*	102	120				
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0				
12. NO (cold) read/3% O_2 (ppm)*	132	120				
13. Carbon Dioxide (%) CO_2	16.0					
14. Carbon Monoxide (ppm) uncor/cor*	20	18				
15. Hydrocarbon (ppm) uncor/cor*	0	0				
16. Sulfur Dioxide (ppm) SO_2 uncor/cor*	100	111				
17. Smoke Spot (Bacharach)	9.0					
18. Atmos. Temp. (°F/°C)	92°F					
19. Dew Point Temp. (°F/°C)						
20. Atmos. Pressure (in. Hg)	30.00					
21. Relative Humidity (%)	48%					
22.						
23. COND:	LOW O_2 SMOKE LIMIT					
24.						
25.	CO Spikes					
26.	at 0.9 O_2					
27.	Unit swinging					
28.						
29.						
30.						

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/5-1 to 4

Test No. ______ Date 6-17-80 Location 7 Engr. TIDONA/HART

Unit No. 11 H13 Fuel OIL Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type JOHNZINK DBA-22

1. Test No.	7/5-1		7/5-2		7/5-3		7/5-4		7/5-5	
2. Date	6-18-80		6-18-80		6-18-80		6-18-80		→	
3. Time	10:48		11:37		12:15		15:15			
4. Load	HIGH		HIGH		HIGH		HIGH		MED	
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		CENTER 25"		CENTER		→			
8. Oxygen (%)	2.8		1.6		1.2		2.9			
9. NOx (hot) read/3% O_2 (ppm)*	105	150	100	139	95	123	112	162		
10. NO (hot) read/3% O_2 (ppm)*	105	150	100	139	95	123	112	162		
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0		
12. NO (cold) read/3% O_2 (ppm)*	152	150	150	139	135	123	163	162		
13. Carbon Dioxide (%)	9.8		13.6		14.0		12.9			
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
17. Smoke Spot (Bacharach)	2		3.5		6.5		1			
18. Atmos. Temp. (°F/°C)	85°F		90°F		89°F		95			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.02		30.02		30.02		29.99			
21. Relative Humidity (%)	62%		54%		54%		45			
22.										
23. COND:	BASELINE		MED. LO O_2		LOW O_2		HIGH O_2			
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No.__________ Date 6-19-80 Location 7 Engr. Tidona/[illegible]

Unit No. 11 H 13 Fuel OIL Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type John Zink DBP-22

1. Test No.	7/6-1		7/6-2		7/6-3		7/6-4			
2. Date	6-19-80		→				→			
3. Time	9:46		11:10		13:25					
4. Load	Low		→		→		→			
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER 25"		→		→					
8. Oxygen (%)	6.7		4.8		2.9		1.7			
9. NOx (hot) read/3% O_2 (ppm)*	82	120	115	170	115	166	100	142		
10. NO (hot) read/3% O_2 (ppm)*	82	120	115	170	115	166	100	142		
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0		
12. NO (cold) read/3% O_2 (ppm)*	95	120	152	170	167	166	152	142		
13. Carbon Dioxide (%)	54		86		98		10.4			
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
16. Sulfur Dioxide (ppm) uncor/cor*	0	?	0	?	0	?	0	0		
17. Smoke Spot (Bacharach)	1.0		1.0		2.0		4.5			
18. Atmos. Temp. (°F/°C)	82°F		86°F		94°C		97°F			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.03		30.03		30.04		30.04			
21. Relative Humidity (%)	66%		54%		38%		46%			
22.										
23. Condi	High O_2		BASELINE		LOW O_2		MIN O_2			
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 7/7-1 Date 6-20-80 Location 7 Engr. TIDONA/HART

Unit No. 11N13 Fuel OIL Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22.

1. Test No.	7/7-1		7/7-2		7/7-3					
2. Date	6-20-80 →									
3. Time	9:53		10:45		11:35					
4. Load	HIGH →									
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER →									
8. Oxygen (%)	3.4		2.6		1.9					
9. NOx (hot) read/3% O_2 (ppm)*	125	164	90	135	112	112				
10. NO (hot) read/3% O_2 (ppm)*	125	164	90	135	112	112				
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0				
12. NO (cold) read/3% O_2 (ppm)*	160	164	137	135	117	139				
13. Carbon Dioxide (%)	9.8		10.2		13.2					
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0				
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0				
16. Sulfur Dioxide (ppm) uncor/cor*	100	118	80	90	80	87				
17. Smoke Spot (Bacharach)	4		3.5		8					
18. Atmos. Temp. (°F/°C)	83°F		83°F		85°F					
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.05		30.08		30.08					
21. Relative Humidity (%)	50%		52%		66%					
22.										
23. COND:	HIGH O2		BASELIN		LOW O2					
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/8 Date 6-20-80 Location ________ Engr. TIDONA

Unit No. 11H13 Fuel Pit.+Ref. Gas Capacity 16,250 bbl/d

Unit Type CRUDE HTR Burner Type Zink DBA-22

	Atom. Steam Inj.		Baseline		Sec. Air Registers 5% Open					
1. Test No.	7/8-1		7/8-2		7/8-3					
2. Date	6-20-80		6-20-80		6-20-80					
3. Time	14:15		15:25		15:45					
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→		→					
8. Oxygen (%)	6.0		3.1		3.4					
9. NOx (hot) read/3% O_2 (ppm)*	72	122	75	110	73	109				
10. NO (hot) read/3% O_2 (ppm)*	72	122	75	110	73	109				
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0				
12. NO (cold) read/3% O_2 (ppm)*	102	122	109	110	107	109				
13. Carbon Dioxide (%)	8.8		10.6		10.4					
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0				
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0				
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0				
17. Smoke Spot (Bacharach)	—		—		—					
18. Atmos. Temp. (°F/°C)	88°F		86°F		86					
19. Dew Point Temp. (°F/°C)	—		—		—					
20. Atmos. Pressure (in. Hg)	30.06		30.06		30.06					
21. Relative Humidity (%)	36		43		43					
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/9-1

Test No. 7/9-1 Date 6-24-80 Location 7 Engr. TIRONE/HART

Unit No. 11 H13 Fuel Refinery GAS Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22 .

	BASELINE									
1. Test No.	7/9-1		7/9-2		7/9-1		7/9-2		7/9-3	
2. Date	6-24-80		—		6-25-80		6-25-80		6-25-80	
3. Time	1347		15:25		9:20		11:50		12:40	
4. Load BBL/DAY	11,456		11,456		11,456		11,456		11,456	
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER ⟶									
8. Oxygen (%)	4.1		4.0		3.9		3.9		3.9	
9. NOx (hot) read/3% O_2 (ppm)*	75	112	65	98	72	102	62	92	57	87
10. NO (hot) read/3% O_2 (ppm)*	75	112	65	98	72	102	62	92	57	87
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	105	112	93	98	97	102	87	92	82	87
13. Carbon Dioxide (%)	7.5		8.8		9.0		11.0		10.2	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		1		.05		—			
18. Atmos. Temp. (°F/°C)	86		87		74		83°F		82°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—		—	
20. Atmos. Pressure (in. Hg)	30.04		30.01		30.10		30.12			
21. Relative Humidity (%)	41		40		62%		60%		56%	
22.										
23. COND:	baseline		LOW Nx		BASELINE		LOW Nx			
24.	(NO 2 air)		AIR LANCE		(NO AIR LANCE)		AIR LANCE			
25.			INSERTED				IN HIGH POS.			
26.			HIGH POS.		⟶					
27.	⟵		⟶		START					
28.	DON'T		USE		HERE					
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/9-4

Test No. 7/9-4 Date 6-25-80 Location 7 Engr. TIDONA / HART

Unit No. 11 H 13 Fuel REFINERY GAS Capacity 16,250 BBL / DAY

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

1. Test No.	7/9-4		7/9-1		7/9-1		7/9-5		7/9-6	
2. Date	6-25		6-25		6-26		6-26		6-26	
3. Time	13:55		15:25		7:35		8:50		9:21	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→		→		→		→	
8. Oxygen (%)	3.7		4.3		4.0		1.3		2.2	
9. NOx (hot) read/3% O_2 (ppm)*	60	78	68	111	90	106	62	82	50	72
10. NO (hot) read/3% O_2 (ppm)*	60	78	68	111	90	106	62	82	50	72
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	75	78	103	111	100	106	60	82	75	72
13. Carbon Dioxide (%)	10.0		9.6		9.6		12.0		11.8	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	1	0
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	85°F		85°F		69°F		70°F		75°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.10		30.08		30.15		30.18		30.18	
21. Relative Humidity (%)	42%		42%		60%		64%		60%	
22.									—	
23. COND:	LOW NOx		BASELINE		BASELINE		BASELINE		LOW NOx	
24. COMMENT:	AIR LANCE ALL IN TO HIGH POS		4% O_2		4% O_2		2% O_2		AIR LANCE IN HIGH POS	
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/6-7

Test No. 7/6-7 Date 6-26-80 Location 7 Engr. TIDONA/HART

Unit No. # H13 Fuel Refinery Gas Capacity 16,250 SCF/day

Unit Type REBOILER HEATER Burner Type John Zink DBA-22.

Mid stage

1. Test No.	7/6-7		7/6-8							
2. Date	6-26-80		6-26-80							
3. Time	10:10		10:55							
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER →									
8. Oxygen (%)	2.0		2.3							
9. NOx (hot) read/3% O_2 (ppm)*	45	63	40	66						
10. NO (hot) read/3% O_2 (ppm)*	45	63	40	60						
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0						
12. NO (cold) read/3% O_2 (ppm)*	67	63	62	60						
13. Carbon Dioxide (%)	11.4		11.4							
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0						
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0						
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0						
17. Smoke Spot (Bacharach)	—		—							
18. Atmos. Temp. (°F/°C)	74°F		77°F							
19. Dew Point Temp. (°F/°C)	—		—							
20. Atmos. Pressure (in. Hg)	30.18		30.18							
21. Relative Humidity (%)	55%		45%							
22.										
23. COND:	LOW NOX		LOW NOX							
24. COMMENT:	2% O2		2% O2							
25.	LANCE IN HIGH POS		LANCE IN 4"							
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/10-1

Test No. 7/10-1 Date 6-26-80 Location 7 Engr. TIDONA/HART

Unit No. 11A13 Fuel REFINERY GAS Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type ZINK DBA 22

1. Test No.	7/10-1		7/10-2		7/10-3		7/10-4		7/10-1	
2. Date	6-26-80		6-26-80		6-26-80		6-26-80		6-26-80	
3. Time	13:10		13:45		14:20		14:50		15:20	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER →									
8. Oxygen (%)	3.9		4.2		4.3		4.2		4.3	
9. NOx (hot) read/3% O_2 (ppm)*	75	107	65	96	63	93	57	86	72	110
10. NO (hot) read/3% O_2 (ppm)*	75	107	65	96	63	93	57	86	72	110
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	102	107	90	96	86	93	80	86	102	110
13. Carbon Dioxide (%)	8.6		7.6		7.2		7.4		7.2	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—					
18. Atmos. Temp. (°F/°C)	84°F		90°F		86°F		85°F		86°F	
19. Dew Point Temp. (°F/°C)	—		—		—					
20. Atmos. Pressure (in. Hg)	30.18		30.18		30.18		30.18		30.18	
21. Relative Humidity (%)	52%		41%		54%		52%		44%	
22.										
23. COND:	BASELINE		4% O2		4% O2		4% O2		BASELINE	
24. COMMENT:	4% O2		LANCE IN 3'		3' POS OF LANCE		3' POS OF LANCE		4% O2	
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.______

Test No. 7/10 Date 6-27-80 Location 7 Engr. [illegible]

Unit No. NH 13 Fuel [illegible] GAS Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type ZINK DBA-22

1. Test No.	7/10-5		7/10-6		7/10-7		7/10-8		7/10-9	
2. Date	6-27-80	→								
3. Time	8:25		9:25		10:05		10:55		11:30	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER	→								
8. Oxygen (%)	3.6		1.7		2.1		1.9		2.1	
9. NOx (hot) read/3% O_2 (ppm)*	77	106	59	88	50	71	48	69	45	61
10. NO (hot) read/3% O_2 (ppm)*	77	106	59	88	50	71	48	69	45	61
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	102	106	94	88	75	71	72	69	64	61
13. Carbon Dioxide (%)	10.2		11.8		10.4		10.6		10.8	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	74°F		78		83°F		85°F		89°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.15		30.16		30.16		30.16		30.14	
21. Relative Humidity (%)	48%		44%		40%		42%		30%	
22.										
23. COND:	BASELINE		BASELINE		LOW NOX 3'		LOW NOX 3'		LOW NOX 3'	
24. COMMENT:	4% O_2		2% O_2		2% O_2		2% O_2		2% O_2	
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No.________ Date 6-27-80 Location 7 Engr. T. BROWN/HART

Unit No. 11-H3 Fuel REFINERY GAS Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type ZINK DBA-22

1. Test No.	7/10-6					
2. Date	6-27-80					
3. Time	12:15					
4. Load						
5. Process Rate						
6. Flue Diam. or Size, ft						
7. Probe Position	1.7					
8. Oxygen (%)	CENTER					
9. NOx (hot) read/3% O_2 (ppm)*	72	98				
10. NO (hot) read/3% O_2 (ppm)*	72	98				
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0				
12. NO (cold) read/3% O_2 (ppm)*	105	98				
13. Carbon Dioxide (%)	9.4					
14. Carbon Monoxide (ppm) uncor/cor*	0	0				
15. Hydrocarbon (ppm) uncor/cor*	0	0				
16. Sulfur Dioxide (ppm) uncor/cor*	0	0				
17. Smoke Spot (Bacharach)	—					
18. Atmos. Temp. (°F/°C)	90°F					
19. Dew Point Temp. (°F/°C)	—					
20. Atmos. Pressure (in. Hg)	30.12					
21. Relative Humidity (%)	38%					
22.						
23. COND:	BASELINE					
24. COMMENT:	2% O_2					
25.						
26.						
27.						
28.						
29.						
30.						

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/11

Test No. 7/11 Date 6-30-80 Location 9 Engr. TIDONA

Unit No. 11 H13 Fuel REFINERY GAS Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type ZINK DBA-22

1. Test No.	7/11-1		7/11-2		7/11-3		7/11-4		7/11-1	
2. Date	6-30		→							
3. Time	8:20		9:49		10:48		11:25		13:55	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→							
8. Oxygen (%)	4.0		3.8		4.0		4.1		3.9	
9. NOx (hot) read/3% O_2 (ppm)*	82	111	65	94	67	98	62	96	75	115
10. NO (hot) read/3% O_2 (ppm)*	82	111	65	94	67	98	62	96	75	115
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	105	111	90	94	92	98	90	96	110	115
13. Carbon Dioxide (%)	8.2		9.6		9.8		9.1		7.6	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—		—			
18. Atmos. Temp. (°F/°C)	82°F		86°F		88°F		92°F		95°F	
19. Dew Point Temp. (°F/°C)	—		—		—		—			
20. Atmos. Pressure (in. Hg)	30.00		30.00		30.00		30.00		30.00	
21. Relative Humidity (%)	52%		42%		40%		30%		30%	
22.										
23. COND:	BASELINE		LOW NOX		LOW NOX		LOW NOX		BASELINE	
24. COMMET:	4% O2		2' POS OF LANCE		2' POS OF		2' POS		4% O2	
25.					LANCE					
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/11-5

Test No. 7/11-5 Date 6-30-80 Location 7 Engr. TIDONP

Unit No. 11 H13 Fuel Refinery Gas Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type ZINK DBA-22

1. Test No.	7/11-5		7/11-6		7/11-7		7/11-8		7/11-9	
2. Date	6-30		6-30		6-30		6-30		6-30	
3. Time	15:05		15:45		16:18		17:06		17:32	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER									
8. Oxygen (%)	2.0		2.1		2.0		1.9		2.0	
9. NOx (hot) read/3% O_2 (ppm)*	75	99	52	77	50	68	42	54	37	53
10. NO (hot) read/3% O_2 (ppm)*	75	99	52	77	50	68	42	54	57	53
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	105	99	61	77	72	68	57	54	56	53
13. Carbon Dioxide (%)	8.6		11.0		10.7		11.4		11.8	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	95°F		95°F		95°F		92°F		90°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.00		30.00		30.00		30.00		30.00	
21. Relative Humidity (%)	40%		38%		38%		46%		49%	
22.										
23. COND:	BASELINE @		LOW NOX @		LOW NOX @		LOW NOX		LOW NOX	
24. COMMENT:	2% O_2		2% O_2		2% O_2		2% O_2		4" LANCE	
25.			2' POS OF →		〃		→		IN HIGH POS	
26.			LANCE							
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/11-10

Test No. 7/11-10 Date 6-30-80 Location 7 Engr. Tidona

Unit No. 11 H13 Fuel Refinery Gas Capacity 16,250 BBL/DAY

Unit Type Crude Heater Burner Type Zink DBA-22

1. Test No.	7/11-10		7/11-1							
2. Date	6-30									
3. Time	17:55									
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	Center									
8. Oxygen (%)	2.0		3.7							
9. NOx (hot) read/3% O_2 (ppm)*	67	92	70	104						
10. NO (hot) read/3% O_2 (ppm)*	67	92	70	104						
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0						
12. NO (cold) read/3% O_2 (ppm)*	97	92	100	104						
13. Carbon Dioxide (%)	11.4		8.4							
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0						
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0						
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0						
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	88°F		88°F							
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.00		30.00							
21. Relative Humidity (%)	47%		47%							
22. COND:	Baseline		Baseline							
23. COMMENTS:	2% O_2		4% O_2							
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/12-1 TO

Test No. ______ Date 7-1-80 Location 7 Engr. HART/TIDONA

Unit No. 11 H 13 Fuel REFINERY GAS Capacity 16,250 BBL/DAY

Unit Type REFINERY PROCESS HTR Burner Type JOHN ZINK DBA 22

1. Test No.	7/12-1		7/12-2		7/12-3		7/12-4		7/12-5	
2. Date	7-1-80		→							
3. Time	0855		0935		1015		1040		1110	
4. Load	LOW		→							
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→							
8. Oxygen (%)	4.0		4.0		3.9		4.0		4.1	
9. NOx (hot) read/3% O_2 (ppm)*	68	100	56	89	52	81	48	77	43	68
10. NO (hot) read/3% O_2 (ppm)*	68	100	56	89	52	81	48	77	43	68
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	94	100	84	89	77	81	73	77	64	68
13. Carbon Dioxide (%)	10.0		10.0		10.3		10.0		10.1	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—		—		—	
18. Atmos. Temp. (°F/°C)	82		83		90		90		88	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.12		30.12		30.12		30.12		30.12	
21. Relative Humidity (%)	56		60		48		45		52	
22.										
23. COND:	BASLINE		LANCES IN		→					
24. AIR LANCE STAGGING HEIGHT	—		4' INSERT		→					
25. STAGGED AIR TOTAL FLOW	—		1183 CFM		1673 CFM		2095 CFM		2445 CFM	
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/12-6 TO 7/12-10

Test No. 7/12-6 TO 7/12-10 Date 7-1-80 Location 7 Engr. HART / TIDONA

Unit No. 11 H 13 Fuel ADSORB GAS Capacity

Unit Type REFINERY PROCESS HTR Burner Type ZINK DBA-22

1. Test No.	7/12-6		7/12-7		7/12-8		7/12-9		7/12-10		7/12-18	
2. Date	7-1-80		→		→		→		→		→	
3. Time	1225		1300		1330		1400		1443		1457	
4. Load	LOW		→		→		→		→		→	
5. Process Rate												
6. Flue Diam. or Size, ft												
7. Probe Position	CENTER		→		→		→		→		→	
8. Oxygen (%)	1.6		1.7		2.0		2.0		2.1		4.2	
9. NOx (hot) read/3% O_2 (ppm)*	45	65	43	62	38	55	35	57	63	90	70	110
10. NO (hot) read/3% O_2 (ppm)*	45	65	43	62	38	55	35	51	63	90	70	110
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	70	65	67	62	58	55	54	51	95	90	103	110
13. Carbon Dioxide (%)	11.6		12.0		11.3		11.3		11.3		10.0	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)												
18. Atmos. Temp. (°F/°C)	93		93		94		95		95		94	
19. Dew Point Temp. (°F/°C)												
20. Atmos. Pressure (in. Hg)	31.13		30.14		30.14		30.14		30.14		30.14	
21. Relative Humidity (%)	42		42		44		43		44		40	
22.												
23. COND:	LANCES IN		→		→		→		BASELINE		BASELINE	
24.	LOW STAG.		MED STAG.		HIGH STAG.		VERY HIGH STAG.		2%		4%	
25. LANCE AIR STAGGING HEIGHT	4' INSERT.		→		→		→		—		—	
26. STAGGED AIR FLOW (CFM)	1188		1491		1960		2207		—		—	
27.												
28.												
29.												
30.												

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No. 7/13-1

Test No. 7/13-1 Date 7-2-80 Location 7 Engr. HART/T. DONA

Unit No. 11 H 13 Fuel Adsorb GAS Capacity

Unit Type REFINERY PROCESS HTR Burner Type JOHN ZINK DBA 22

STAGGED HEIGHT VARIATION @ SET O_2

1. Test No.	7/13-1		7/13-2		7/13-3		7/13-4		7/13-5		7/13-1B	
2. Date	7-2-80		→		→		→		→			
3. Time	0800		0900		0920		10:08		10:38		11:30	
4. Load	LOW		→		→		→		→		→	
5. Process Rate 1847.7 bbl/d	6.2		→		→		→		→		→	
6. Flue Diam. or Size, ft												
7. Probe Position	CENTER		→		→		→		→		→	
8. Oxygen (%)	4.0		4.2		4.2		4.0		4.1		3.9	
9. NOx (hot) read/3% O_2 (ppm)*	75	96	59	87	58	87	58	87	55	85	65	98
10. NO (hot) read/3% O_2 (ppm)*	75	96	59	87	58	87	58	87	55	85	65	98
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	-0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	91	96	81	87	81	87	83	87	80	85	93	98
13. Carbon Dioxide (%)	10.2		10.0		10.0		10.3		10.2		10.0	
14. Carbon Monoxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor	0	0	0	0	0	0	0	0	0	0	0	0
17. Smoke Spot (Bacharach)	—		—		—		-		—		—	
18. Atmos. Temp. (°F/°C)	76		80		81		81		84			
19. Dew Point Temp. (°F/°C)	—		-		-		—		-		—	
20. Atmos. Pressure (in. Hg)	29.80		29.80		29.80		29.80		30.12		30.12	
21. Relative Humidity (%)	71		64		62		62		64			
22.												
23. COND:	BASELINE		LANCES IN		→		→		→		BASELINE	
24.	4%										4%	
25. AIR LANCE STAGGING HEIGHT	—		4' INSERT		3' INSERT		2' INSERT		1' INSERT		—	
26. STAGGED AIR FLOW (SCFM)	—		1660		1660		1660		1660		—	
27.												
28. COMMENTS:	HIGH											
29.	HUMIDITY											
30.												

*Correction to 3% O_2 should not be performed if tho value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/14-1 TO

Test No. 7/14-1 TO Date 7-8-80 Location SITE 7 Engr. HART

Unit No. 11 H 13 Fuel OIL Capacity

Unit Type REFINERY PROCESS HEATER Burner Type JOHN ZINK DBA 22.

1. Test No.	7/14-1		7/14-2		7/14-3		7/14-4		7/14-18	
2. Date	7-8-80		——		——		——		——→	
3. Time	0915		10:20		11:05		1148		12:20	
4. Load	HIGH		——		——		——		——→	
5. Process Rate										
6. Flue Diam. or Size, ft	6'		——		——		——		——→	
7. Probe Position	CENTER		——		——		——		——→	
8. Oxygen (%)	3.9		4.0		4.0		3.8		4.0	
9. NOx (hot) read/3% O_2 (ppm)*	150	205	160	230	175	246	176	249	143	209
10. NO (hot) read/3% O_2 (ppm)*	150	205	160	230	175	246	176	249	143	209
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	195	206	217	230	232	246	238	249	197	209
13. Carbon Dioxide (%)	10.2		10.1		10.0		11.0			
14. Carbon Monoxide (ppm) uncor/cor*	29	29	0	0	0	0	0	0	30	32
15. Hydrocarbon (ppm) uncor/cor*	0	+	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	195	237	195	238	200	244	200	241	195	238
17. Smoke Spot (Bacharach)	#9 +		5		4.5		3		(blk) 9+	
18. Atmos. Temp. (°F/°C)	75		73		81		83		81	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.02		30.01		30.01		30.01		30.01	
21. Relative Humidity (%)	63		62		42		42		44	
22.										
23.										
24. COND:	BASELINE		LANCES IN		——		——→		BASELINE	
25.	4%									
26. AIR LANCE STAGGING HEIGHT	—		4' INSERT		3' INSERT		2' INSERT		—	
27. STAGGED AIR FLOW	—		2073		2073		2073		—	
28.										
29. COMMENTS:	SMOKEY								SMOKEY	
30.	FIRE BOX								FIRE BOX	

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/14-

Test No.____ Date 9-8-80 Location SITE 7 Engr. HART/TIDONA

Unit No. 11 H 13 Fuel OIL Capacity____

Unit Type REFINERY PROCESS HEATER Burner Type ZINK DBA 22

1. Test No.	7/14-5		4/14			
2. Date	7-8-80					→
3. Time	1435					
4. Load	HIGH					
5. Process Rate						
6. Flue Diam. or Size, ft	6'					
7. Probe Position	CENTER					→
8. Oxygen (%)	4.0					
9. NOx (hot) read/3% O_2 (ppm)*	130	186				
10. NO (hot) read/3% O_2 (ppm)*	130	186				
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0				
12. NO (cold) read/3% O_2 (ppm)*	176	186				
13. Carbon Dioxide (%)	10.0					
14. Carbon Monoxide (ppm) uncor/cor*	30	32				
15. Hydrocarbon (ppm) uncor/cor*	0	0				
16. Sulfur Dioxide (ppm) uncor/cor*	180	220				
17. Smoke Spot (Bacharach)	.5					
18. Atmos. Temp. (°F/°C)	88					
19. Dew Point Temp. (°F/°C)						
20. Atmos. Pressure (in. Hg)	29.99					
21. Relative Humidity (%)	42					
22.						
23. COND%	baseline		LANCES IN			
24.						
25. LANCE AIR STAGGING HEIGHT	—		4' INSERT			
26. STAGGED AIR FLOW	—					
27.						
28. COMMENTS	CLEARED					
29.	FIRE BOX					
30.						

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/15-1

Test No. 7/15- Date 7-9-80 Location SITE 7 Engr. HART / TIDONA

Unit No. 11 H 13 Fuel OIL Capacity 16250 bbl/d

Unit Type REFINERY PROCESS HEATER Burner Type ZINK DBA 22

1. Test No.	7/15-1		7/15-2a		7/15-3		7/15-4		7/15-5	
2. Date	7-9-80								→	
3. Time	08:20		09:27		10:30		11:20		11:50	
4. Load	MED.								→	
5. Process Rate										
6. Flue Diam. or Size, ft	6'								→	
7. Probe Position	CENTER								→	
8. Oxygen (%)	4.1		4.0		4.0		4.1		4.2	
9. NOx (hot) read/3% O_2 (ppm)*	155	201	147	203	138	194	140	199	140	206
10. NO (hot) read/3% O_2 (ppm)*	155	201	147	203	138	194	140	199	140	206
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	189	201	192	203	183	194	187	199	192	206
13. Carbon Dioxide (%)	10.6		10.6		10.3		10.8		10.6	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	70	(?)	150	183	150	183	110	135	150	185
17. Smoke Spot (Bacharach)	1		1½		2		1½		1	
18. Atmos. Temp. (°F/°C)	70		73		76		73		74	
19. Dew Point Temp. (°F/°C)	—		—		—					
20. Atmos. Pressure (in. Hg)	30.10		30.10		30.10		30.10		30.10	
21. Relative Humidity (%)	61		53		49		60		58	
22.			SECONDARY		#2 REG. 90% OPEN		———			
23. COND:	BASELINE		AIR REGISTERS		STAGING		———			
24.			90% OPEN							
25. LANCE AIR STAGGING HEIGHT (FT)	—		—		4'		3'		2'	
26. STAGED AIR FLOW (CFM)	—		—		2068		2068		2068	
27.										
28. COMMENTS:										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/15

Test No. 7/15 Date 7-9-80 Location 7 Engr. HART, TIDONA FROHOFF / PIONESSA

Unit No. 11H13 Fuel Oil + Gas Capacity 16250 bbl/d

Unit Type crude process heater Burner Type DBA-22

1. Test No.	7/15-2b		7/15-6		7/15-6		7/15-7:		7/15-8	
2. Date	7-9-80		7-11-80		7-11-80		7-11-80		7-11-80	
3. Time	12:20		810		1115		12:15		1325	
4. Load	MED.		med		MED		MED		med.	
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→		→		→		→	
8. Oxygen (%)	4.15		3.9		3.75		4.0		4.2	
9. NOx (hot) read/3% O_2 (ppm)*	142	207	145	193	144	150	127	193	129	191
10. NO (hot) read/3% O_2 (ppm)*	142	207	145	193	144	150	127	193	128	191
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	194	207	183	193	199	208	182	193	178	191
13. Carbon Dioxide (%)	10.6		11.0		11.0		11.0		11.0	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	140	172	80	97	180	216	150	183	155	191
17. Smoke Spot (Bacharach)	0		-1		2.5		1		5	
18. Atmos. Temp. (°F/°C)	81		76		87		90		91	
19. Dew Point Temp. (°F/°C)	–									
20. Atmos. Pressure (in. Hg)	30.10		30.05		30.03		30.03		29.98	
21. Relative Humidity (%)	45		66		46		45		40	
22.										
23. COMMENT:	SEC. AIR						4' STAGING		6'	
24.	REC. 90% OAT						4% O2			
25.										
26. COND:	NO		baseline		BASELINE					
27. Staging setm	STAGING						2090		2100	
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 7/15 Date 7-11-80 Location 7 Engr. HART, TIDONA

Unit No. 11H13 Fuel Oil+Gas Capacity 16250 bbl/d

Unit Type Burner Type DBA-22

1. Test No.	7/15-9		7/15-6				
2. Date	7-11-80		7-11-80				
3. Time	1425		1515				
4. Load	med.		med.				
5. Process Rate							
6. Flue Diam. or Size, ft							
7. Probe Position	Center		Center				
8. Oxygen (%)	4.1		4.25				
9. NOx (hot) read/3% O_2 (ppm)*	125	190	138	213			
10. NO (hot) read/3% O_2 (ppm)*	125	190	138	213			
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0			
12. NO (cold) read/3% O_2 (ppm)*	178	190	198	213			
13. Carbon Dioxide (%)	11.0		11.2				
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0			
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0			
16. Sulfur Dioxide (ppm) uncor/cor*	140	172	130	161			
17. Smoke Spot (Bacharach)	0		–				
18. Atmos. Temp. (°F/°C)	90		92				
19. Dew Point Temp. (°F/°C)	-						
20. Atmos. Pressure (in. Hg)	29.98		29.95				
21. Relative Humidity (%)	40		39				
22.							
23.	8 ft		Baseline				
24.							
25.							
26.							
27.							
28.							
29.							
30.							

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7-16-1 TO

Test No. 7/16-1 Date 7-15 80 Location SITE 7 Engr. TIDONA/HART

Unit No. 1/H13 Fuel OIL/GAS Capacity

Unit Type REFINERY CRUDE HEATER Burner Type ZINK DBA 22

1. Test No.	7/16-1		7/16-2		7/16-3		7/16-4		7/16-26	
2. Date	7-15-80		→							
3. Time	0940		1035		1125		1150			
4. Load	HIGH		→							
5. Process Rate										
6. Flue Diam. or Size, ft	4'		→							
7. Probe Position	CENTER		→							
8. Oxygen (%)	4.1		4.0		4.0		4.0		4.0	
9. NOx (hot) read/3% O_2 (ppm)*	140	209	115	177	115	185	108	166	115	178
10. NO (hot) read/3% O_2 (ppm)*	140	209	115	177	115	185	108	166	115	178
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	196	209	167	177	175	185	157	166	168	178
13. Carbon Dioxide (%)	10.6		10.6		10.6		10.6		10.6	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	1000	1227	300	366	500	610	130	158	280	342
17. Smoke Spot (Bacharach)	2		0		2		2			
18. Atmos. Temp. (°F/°C)	82		85		92		92			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.00		30.00		30.00		30.00			
21. Relative Humidity (%)	50		48		42		40		-	
22.										
23. COND:	BASELINE		LANCES IN		→		→		→	
24.	4% O_2									
25. LANCE AIR STAGING HEIGHT	—		4'		4'		4'		4'	
26. STAGED AIR FLOW (CFM)	—		1668		2092		2366		1680	
27.										
28. COMMENTS	HIGH				HIGH				REPEAT	
29.	SO_2 CONC.				SO_2 CONC.					
30. *	INNERACTION BETWEEN NO AND SO_2									

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. 7/16-3B Date 7-15-80 Location SITE 7 Eng.

Unit No. 11 H 13 Fuel ~~FUEL~~ ABSORBER GAS/OIL Capacity 161250 BBL/DAY

Unit Type REFINERY CRUDE HEATER Burner Type ZINK DBA 22

1. Test No.	7/16-38		7/16-1B		7/16-5		7/16-6		7/16-7	
2. Date	7-15-80		—		—		—		—	
3. Time	1230		1300		16:20		17:00		17:17	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	4' —		—		—		—		—	
7. Probe Position	Center —		—		—		—		→	
8. Oxygen (%)	4.3		4.0		2.0		2.1		2.2	
9. NOx (hot) read/3% O_2 (ppm)*	110	179	127	191	117	156	115	160	110	156
10. NO (hot) read/3% O_2 (ppm)*	110	179	127	191	117	156	115	160	110	156
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	166	179	180	191	165	156	168	160	163	156
13. Carbon Dioxide (%)	10.6		10.6		10.6		12.0		12.4	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	120	149	110	134	120	131	120	132	120	132
17. Smoke Spot (Bacharach)	—		.1		—		.3		0.1	
18. Atmos. Temp. (°F/°C)	92		91		96		94		97	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	30.00		29.95		29.95		29.95		29.95	
21. Relative Humidity (%)	40		40		32		38		34	
22.										
23. COND°	LANCES IN		BASELINE		BASELINE					
24.			4% O_2		2% O_2		2% O_2		2% O_2	
25. LANCE AIR STAGING HEIGHT	4'		—		—		4'		4'	
26. STAGED AIR FLOW (CFM)	2092		—		—		1200		1700	
27.										
28. COMMENTS	REPEAT									
29.	LOWER SO_2									
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7/16-8

Test No. 7/16-8 Date 7/15/80 Location SITE 7 Engr. TIPPON/HUNT

Unit No. 11 H13 Fuel REFIN/NG Capacity 16,250 BBL/DAY

Unit Type CRUDE HEATER Burner Type Zink DBA-22

1. Test No.	7/16-8		7/16 7C							
2. Date	7/15/80		7/15/80							
3. Time	1740		1800							
4. Load	HIGH		HIGH							
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CNTR		—							
8. Oxygen (%)	2.3		3.8							
9. NOx (hot) read/3% O_2 (ppm)*	115	157	127	192						
10. NO (hot) read/3% O_2 (ppm)*	115	157	127	192						
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0						
12. NO (cold) read/3% O_2 (ppm)*	163	157	183	192						
13. Carbon Dioxide (%)	11.6		11.0							
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0						
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0						
16. Sulfur Dioxide (ppm) uncor/cor*	120	133	120	145						
17. Smoke Spot (Bacharach)	.1		—							
18. Atmos. Temp. (°F/°C)	97°F		97°F							
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.55		29.55							
21. Relative Humidity (%)	32		32							
22.										
23. COND:	2% O2		4% O2							
24.										
25. LARGE AIR STAGING HIGHT :	4'		4'							
26. STAGED AIR FLOW :	2076		~~0~~							
27.										
28. COMMENT :			BASELINE							
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/17 Date 7-10-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Absorber Gas + No.6 Oil Capacity 16,250 bbl/d or 55×10⁶ Btu/h

Unit Type Crude Heater Burner Type Zink DBA-22

1. Test No.	7/17-1P		7/17-1P				
2. Date	7-10-80		7-10-80				
3. Time	16:00		18:25				
4. Load (x1847.7 = bbl/d)	6.2		6.2				
5. Process Rate							
6. Flue Diam. or Size, ft	4'		4'				
7. Probe Position	CTR		CTR				
8. Oxygen (%)	3.7		3.85				
9. NOx (hot) read/3% O_2 (ppm)*	148	202	155	209			
10. NO (hot) read/3% O_2 (ppm)*	148	202	155	209			
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0			
12. NO (cold) read/3% O_2 (ppm)*	194	202	200	209			
13. Carbon Dioxide (%)	11.2		12.0				
14. Carbon Monoxide (ppm) uncor/cor*	0		0				
15. Hydrocarbon (ppm) uncor/cor*	0		0				
16. Sulfur Dioxide (ppm) uncor/cor*	130	156	180	217			
17. Smoke Spot (Bacharach)	0		0				
18. Atmos. Temp. (°F/°C)	89		88				
19. Dew Point Temp. (°F/°C)	—		—				
20. Atmos. Pressure (in. Hg)	30.02		29.99				
21. Relative Humidity (%)	44		44				
22.							
23.							
24.	Baseline		⟶				
25.	Partic		⟶				
26.							
27.							
28.							
29.							
30.							

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/17-2P Date 7-16-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel No. 6 Oil +Ads. Gas Capacity 16,250 bbl/d

Unit Type CRUDE HEATER Burner Type ZINK DBA-22

1. Test No.	7/17-2P		7/17-2P				
2. Date	7-16-80		7-16-80				
3. Time	15:55		20:25				
4. Load							
5. Process Rate (10³bbl/d)	11.5		11.5				
6. Flue Diam. or Size, ft							
7. Probe Position	CENTER		CENTER				
8. Oxygen (%)	4.1		3.8				
9. NOx (hot) read/3% O_2 (ppm)*	145	219	125	188			
10. NO (hot) read/3% O_2 (ppm)*	145	219	125	188			
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0			
12. NO (cold) read/3% O_2 (ppm)*	206	219	180	188			
13. Carbon Dioxide (%)	11.5		11.0				
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0			
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0			
16. Sulfur Dioxide (ppm) uncor/cor*	190	234	170	133			
17. Smoke Spot (Bacharach)	1/2		1 1/2				
18. Atmos. Temp. (°F/°C)	100		96				
19. Dew Point Temp. (°F/°C)	73		74				
20. Atmos. Pressure (in. Hg)	29.96		29.94				
21. Relative Humidity (%)	26		36				
22.							
23.							
24.							
25.	BASELINE →						
26.	PARTIC.		Andersen				
27.							
28. Oil/Gas	50/50		30/70				
29.							
30.							

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No._______

Test No. 7/17-3P Date 7-17-80 Location 7 Engr. H&ET

Unit No. 11H13 Fuel #6 Oil +Ref. Gas Capacity 10250 BBL/d

Unit Type Crude Heater Burner Type Zink DAA-22

1. Test No.	7/17-3P		7/17-3P		7/17-3P					
2. Date	7-17		7-17		7-17					
3. Time	955		1225		16:35					
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position										
8. Oxygen (%)	4.0		5.2		4.1					
9. NOx (hot) read/3% O_2 (ppm)*	149	223	153	234	125	192				
10. NO (hot) read/3% O_2 (ppm)*	149	223	153	234	125	192				
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0				
12. NO (cold) read/3% O_2 (ppm)*	211	223	205	234	180	192				
13. Carbon Dioxide (%)	11.2		11.7		8.8					
14. Carbon Monoxide (ppm) uncor/cor*	0	0	-	-	0	0				
15. Hydrocarbon (ppm) uncor/cor*	0	0	-	-	0	0				
16. Sulfur Dioxide (ppm) uncor/cor*	130	163	140	189	120	151				
17. Smoke Spot (Bacharach)	1.		0.5		0.5					
18. Atmos. Temp. (°F/°C)	88		97		97					
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.96		29.96		29.96					
21. Relative Humidity (%)	37		32		29					
22.										
23.	BASELINE		BASELINE		BASELINE					
24.	PARTIC →									
25.	ANDERSEN #2				ANDERSEN #3					
26.					BRN #4					
27.					PLUGGED					
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/18 Date 7-16-80 Location 7 Engr. Tidona, Hart

Unit No. 1/H13 Fuel ADSORBER GAS + No. 6 Oil Capacity 16250 bbl/d

Unit Type CRUDE HEATER Burner Type ZINK DBA-22

1. Test No.	7/18-1		7/18-2		7/18-3		7/18-4		7/18-5	
2. Date	7-16-80		7-16-80		7-16-80		7-16-80		7-16-80	
3. Time	10:07		11:15		13:15		13:20		13:45	
4. Load										
5. Process Rate (10^3 bbl/d)	11.5		11.5		11.5		11.5		11.5	
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		CENTER		CENTER		CENTER		CENTER	
8. Oxygen (%)	4.0		1.9		2.7		2.25		2.1	
9. NOx (hot) read/3% O_2 (ppm)*	154	221	124	160	121	177	123	179	120	172
10. NO (hot) read/3% O_2 (ppm)*	154	221	124	160	121	177	123	179	120	172
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	209	221	170	160	186	177	186	179	181	172
13. Carbon Dioxide (%)	11.0		13.4		13.3		13.1		13.3	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	190	232	210	228	200	219	240	265	220	241
17. Smoke Spot (Bacharach)	1		3½		—		2		2	
18. Atmos. Temp. (°F/°C)	89		92		96		96		97	
19. Dew Point Temp. (°F/°C)	69		70		74		74		74	
20. Atmos. Pressure (in. Hg)	30.04		30.04		30.04		30.01		30.00	
21. Relative Humidity (%)	36		33		36		36		33	
22.										
23.										
24.										
25. Stage Height, ft	—		—		4'		4'		4'	
26. Staged Air Flow, cfm	—		—		1200		1200		1665	
27.			2% O_2		——————→					
28.	BASELINE				Primary air		Prim. air			
29.			Golksoyr-		reg. 50% open		100% open			
30.			Ross		Sec. reg. 80%		Sec. air 90% open better fire			

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/18 Date 7-16-80 Location 7 Engr. Tidmo, Hart

Unit No. 11H13 Fuel No. 6 Oil + Ads. Gas Capacity 16,250 bbl/d

Unit Type CRUDE HTR Burner Type ZINK DBA-22

1. Test No.	7/18-6		7/18-7		7/18-8					
2. Date	7-16-80		7-16-80		7-16-80					
3. Time	14:07		15:00		15:55					
4. Load										
5. Process Rate (10^3 bbl/d)	11.5		11.5		11.5					
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		CENTER		CENTER					
8. Oxygen (%)	2.15		1.9		4.1					
9. NOx (hot) read/3% O_2 (ppm)*	113	166	118	179	145	219				
10. NO (hot) read/3% O_2 (ppm)*	113	166	115	179	145	219				
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	3	0	0	0				
12. NO (cold) read/3% O_2 (ppm)*	174	166	190	179	206	219				
13. Carbon Dioxide (%)	11.3		12.9		11.5					
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0				
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0				
16. Sulfur Dioxide (ppm) uncor/cor*	215	236	210	228	190	233				
17. Smoke Spot (Bacharach)	2		3		1/2					
18. Atmos. Temp. (°F/°C)	99		98		100					
19. Dew Point Temp. (°F/°C)	75		74		73					
20. Atmos. Pressure (in. Hg)	30.00		29.99		29.96					
21. Relative Humidity (%)	33		31		26					
22.										
23.										
24. Stage Height, ft	4'		—		—					
25. Staged Air Flow, cfm	2100		0		0					
26.										
27.			2% O_2		4% O_2					
28.					BASELINE					
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/19-1P Date 7-18-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel No. 6 Oil + Adsorber Gas Capacity 16,250 bbl/d

Unit Type CRUDE HEATER Burner Type Zink DBA-22

Andersen #4 Partic.

1. Test No.	7/19-1		7/19-1P		7/19-1P		7/19-1			
2. Date	7-18-80		7-18-80		7-18-80		7-18-80			
3. Time	09:45		11:20		16:00		16:35			
4. Load										
5. Process Rate (10^3 bbl/d)	11.5		11.5		11.5		11.5			
6. Flue Diam. ~~[illegible]~~, ~~ft~~ in	50.5		50.5		50.5		50.5			
7. Probe Position	CENTER		CENTER		CENTER		CENTER			
8. Oxygen (%)	4.15		1.9		2.7		4.0			
9. NOx (hot) read/3% O_2 (ppm)*	165	240	116	160	140	192	150	227		
10. NO (hot) read/3% O_2 (ppm)*	165	240	116	160	140	192	150	227		
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0		
12. NO (cold) read/3% O_2 (ppm)*	225	240	170	160	195	192	214	227		
13. Carbon Dioxide (%)	11.5		12.3		11.7		10.2			
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
16. Sulfur Dioxide (ppm) uncor/cor*	190	232	185	199	180	191	150	182		
17. Smoke Spot (Bacharach)	4		2 1/2		2		1/2			
18. Atmos. Temp. (°F/°C)	88		94		102		101			
19. Dew Point Temp. (°F/°C)	72		74		74		74			
20. Atmos. Pressure (in. Hg)	29.85		29.86		29.80		29.80			
21. Relative Humidity (%)	47		39		24		26			
22.										
23.			LOW NO_x		→					
24.	BASELINE =		2083 cfm		→		REPEAT			
25.			Staging				BASELINE			
26.	SMOKE SPOT		Adjusted O_2							
27.	IS HIGH		reg. slightly							
28.			Reduced oil							
29.			press. at							
30.			manifold 2 psi Still Smoky				Clear			

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.________

Test No. 7/19-2&3P Date 7-21-80 Location 7 Engr. HART

Unit No. #H13 Fuel Oil+Ref. Gas Capacity 16250 BBL/D

Unit Type crude heater Burner Type Zink DBA-22

1. Test No.	7/19-2		7/19-2P		7/19-3P		7/19-3P		7/19-3	
2. Date	7-21		7-21		7/21		7/21		7-21	
3. Time	0925		1135		14:15		17.45		18:25	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft	4'		→							
7. Probe Position	center		→							
8. Oxygen (%)	3.8		2.05		2.1		2.4		4.1	
9. NOx (hot) read/3% O_2 (ppm)*	160	224	130	171	137	176	137	187	145	227
10. NO (hot) read/3% O_2 (ppm)*	160	224	130	171	137	176	137	187	145	227
11. NO_2 (hot) read/3% O_2 (ppm)*	0	0	0	0	0	0	0	0	0	0
12. NO (cold) read/3% O_2 (ppm)*	214	224	180	171	185	176	193	187	213	~~227~~
13. Carbon Dioxide (%)	11.65		12.8		10.1 (?)		12.8		9.2	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
16. Sulfur Dioxide (ppm) uncor/cor*	200	248	200	225	120	125(?)	190	201	160	186
17. Smoke Spot (Bacharach)	1		6		3.5		3.0		—	
18. Atmos. Temp. (°F/°C)	86		90		98		100		98	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.93		29.93		29.88		29.88		29.88	
21. Relative Humidity (%)	48		47		32		30		32	
22.										
23. STAGED O_2 flow scfm			2088		2113					
24.	baseline		low NOx		Low NOx		low NOx		baseline	
25.	4%									
26.										
27.			SMOKY BOX		Particulate					
28.					7/19-3P					
29.			PARTICULATE							
30.			IN PROGRESS							

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

UNIT OPERATING DATA

Test No. 7/1- Date 6-10-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Reabsorber Gas Capacity 18000 bbl/d

Unit Type Crude Heater Burner Type Zink DEA-22

Test Description: Baseline, O_2 swing at "normal" load

1. Test Number	7/1-1	7/1-1			
2. Date	6-10				
3. Time	10:09				
4. Load x 10^6 Btu/hr	5				
5. Process Rate x 1847.7 bbl/d	5.95				
6. Crude T_{in} (°F)	449				
7. Crude T_{out} (°F) East	644				
8. Crude T_{out} (°F) West	644				
9. Crude P_{in} (psig) East →	160				
10. Crude P_{in} (psig) West ←	160				
11. Crude P_{out} (psig)					
12. Reabsorber gas in x 205.856 (10^3 scf/d)					
13. Natural gas in x 169.044 (10^3 scf/d)					
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	9				
17. Burner #2	28"				
18. Burner #3	9				
19. Burner #4	9				
20. Burner #5	0				
21. Burner #6	9.9				

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UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

	5/1-1				
22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
31. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	723				
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	80				
37. Bottom Furnace P (iwg)					
38. Convective P (iwg)					
39. Stack P (iwg)					
40. Air Registers (% open)					
41. Crude API Gravity					
42. Flame Observations	short, turbulent				
43. Other Observations					

UNIT OPERATING DATA

est No. 7/1-1,2 Date 6-11-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel · Natural Gas Capacity ~~1400~~ 16,250 bbl/d

Unit Type crude heater Burner Type Zink DBA-22

Test Description: Baseline, O_2 swing at "normal" load

1. Test Number	7/1-1	7/1-1	7/1-1	7/1-1	7/1 -2
2. Date	6-11	6-11	6-11	6-11	
3. Time	1033/1041	1104/1114	1147	1306	1430
4. Load x 10^6 Btu/hr input	~71.7 hr	~71.7			
5. Process Rate x 1847.7 bbl/d	6.1	6.1	6.1	6.1	6.1
6. Crude T_{in} (°F)	407	409	410	410	410
7. Crude T_{out} (°F) East	649	649	649	651	648
8. Crude T_{out} (°F) West	650	652	651	649	646
9. Crude P_{in} (psig) East	155	155	155	150	150
10. Crude P_{in} (psig) West	155	150	150	150	160
11. Crude P_{out} (psig)	–	–	–	35.5	35.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	~~4.4~~	~~4.39~~	~~4.45~~	~~4.4~~	~~4.25~~
13. Natural gas in x 169.044 (10^3 scf/d)	4.4	4.39	4.45	4.4	4.25
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	12	11.95	11.9	11.6	11.0
17. Burner #2	11.5	11.5	11.3	11	10.7
18. Burner #3	12.1	11.8	11.9	11.7	11.0
19. Burner #4	12	11.9	11.9	11.6	10.8
20. Burner #5	0-0.3	–	–	12.4	11.6
21. Burner #6	12.7	12.6	12.6	12.5	11.6

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UNIT OPERATING DATA - CONTINUED

Test No. 7/1-1 **Date** 6-11-90 **Location** 7 **Engr.** [illegible]

Unit No. 11H13 **Fuel** Natural Gas **Capacity** ~~17500~~ 16,350 bbl/d

Unit Type crude process heater **Burner Type** DEA-22

Test Description: Baseline

22. *2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. *2 air damper, % open					
.. *2 air T (°F) #1					
32. *2 air T (°F) #2					
33. *2 air T (°F) #3					
34. Stack T (°F)	717	717	716	714	683
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	50	50	50	50	~43
37. Bottom Furnace P (iwg)	-.05	-.04	-0.02	-.02	-.04
38. Convective P (iwg)	-.02	-.01	-.01	-.01	+.05
39. Stack P (iwg)	-.02	+.05	-.01	-.01	+.04
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	24.8	24.8	24.8	24.9	
42. Flame Observations	very blue; non-luminous	& turbulent	Same	Same	
43. Other Observations	baseline	baseline	base line	baseline	low O_2

UNIT OPERATING DATA

ıst No. 7/1-~~1,2~~ 3 Date 6-11-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Natural Gas Capacity ~~16000~~ 16,250 bbl/d

Unit Type Crude Process Heater Burner Type Zink DBA-22

Test Description: Baseline

1. Test Number	7/1-3	7/1-3			
2. Date	6-11	6-11			
3. Time	1533	1632			
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.1	6.1			
6. Crude T_{in} (°F)	410	408			
7. Crude T_{out} (°F) East	643	648			
8. Crude T_{out} (°F) West	643	650			
9. Crude P_{in} (psig) East		155			
10. Crude P_{in} (psig) West		150			
11. Crude P_{out} (psig)		35.5			
12. Reabsorber gas in x 205.856 (10^3 scf/d)	~~4.7~~	~~4.55~~			
13. Natural gas in x 169.044 (10^3 scf/d)	4.7	4.55			
14. Fuel oil in	UNIT IN TROUBLE!				
15. Fuel P/steam P (psig)					
16. Burner #1		12.5			
17. Burner #2		12.5			
18. Burner #3		13.1			
19. Burner #4		12.9			
20. Burner #5		13.6			
21. Burner #6		13.6			

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UNIT OPERATING DATA - CONTINUED

Test No. 7/1-$\overset{3}{4c}$ **Date** 6-11-80 **Location** 7 **Engr.**

Unit No. 11 H 13 **Fuel** MG **Capacity** 16,250 bbl/d

Unit Type **Burner Type**

Test Description:

22. °2 air flow total P	DATA NOT TAKEN BECAUSE UNIT WAS VIBRATING					
23. P to Burner #1						
24. P to Burner #2						
25. P to Burner #3						
26. P to Burner #4						
27. P to Burner #5						
28. P to Burner #6						
29. Staging height (ft)						
30. °2 air damper, % open						
31. °2 air T (°F) #1						
32. °2 air T (°F) #2						
33. °2 air T (°F) #3						
34. Stack T (°F)	660	740				
35. Fuel Oil T (°F)						
36. Stack Damper (% open)	~40	60				
37. Bottom Furnace P (iwg)		-0.06				
38. Convective P (iwg)		-0.02				
39. Stack P (iwg)		+0.04				
40. Air Registers (% open)		50				
41. Crude API Gravity						
42. Flame Observations		Very little yellow, mostly blue				
43. Other Observations	smoke limit	high O$_2$				

UNIT OPERATING DATA

t No. 7/1-1,4 Date 6-12-80 Location 7 Engr. Tidona, Hart

Unit No. 11413 Fuel Natural Gas Capacity 16,250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: med. load (baseline, low O_2),

1. Test Number	7/1-1	7/1-4			
2. Date	6-12	6-12			
3. Time	0954	1150			
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.1	6.1			
6. Crude T_{in} (°F)	400	406			
7. Crude T_{out} (°F) East	647	645			
8. Crude T_{out} (°F) West	646	643			
9. Crude P_{in} (psig) East	160	155			
10. Crude P_{in} (psig) West	150	150			
11. Crude P_{out} (psig)	37.5	38.4			
12. Reabsorber gas in x 205.856 (10^3 scf/d)	—	—			
13. Natural gas in x 169.044 (10^3 scf/d)	4.6	4.3			
14. Fuel oil in	–	–			
15. Fuel P/steam P (psig)	–	–			
16. Burner #1	12.4	11.0			
17. Burner #2	12.0	10.5			
18. Burner #3	12.0	11.2			
19. Burner #4	12.4	11.0			
20. Burner #5	13.2	11.8			
21. Burner #6	13.3	11.8			

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/1-1,4 Date 6-12-80 Location 7 Engr.

Unit No. 11 H13 Fuel NG,T Capacity 16,250 bbl/d

Unit Type Burner Type

Test Description:

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
°2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	719	682			
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	50	41			
37. Bottom Furnace P (iwg)	+.02	0.00			
38. Convective P (iwg)	+.05	+0.03			
39. Stack P (iwg)	+.08	+0.04			
40. Air Registers (% open)	50	50			
41. Crude API Gravity	26.9	26.8			
42. Flame Observations	blu turb.	Yellow tinge to flame			
43. Other Observations	baseline	Min. O2			

UNIT OPERATING DATA

Test No. 7/2 Date 6-12-80/[illegible] Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Nat Gas (?) Capacity ~~[illegible]~~ 16,250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: High Load, Baseline

1. Test Number	7/2-1	7/2-1	7/2-1	7/2-2	
2. Date	6-12	6-12	6-12	6-12	
3. Time	1500	1539	1622	1700	
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.7	7.7	7.7	7.7	
6. Crude T_{in} (°F)	378	379	378	378	
7. Crude T_{out} (°F) East	647	647	645	646	
8. Crude T_{out} (°F) West	642	643	641	642	
9. Crude P_{in} (psig) East	180	180	179	180	
10. Crude P_{in} (psig) West	173	172	172	175	
11. Crude P_{out} (psig)	45	45	44.5	45.3	
12. Reabsorber gas in x 205.856 (10^3 scf/d)					
13. Natural gas in x 169.044 (10^3 scf/d)	6.2	6.2	6.2	6.3	
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	21	21	21.2	22.3	
17. Burner #2	21	21	21	21	
18. Burner #3	21	21	21	21.8	
19. Burner #4	21	21	20.8	21.8	
20. Burner #5	22	22	21.8	22.6	
21. Burner #6	21.8	21.8	21.5	22.5	

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UNIT OPERATING DATA - CONTINUED

Test No. 7/2 Date 6-12-80 Location 7 Engr.

Unit No. 11 H 13 Fuel HGO + Capacity 16 250 bbl/d

Unit Type Burner Type

Test Description:

22. *2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. *2 air damper, % open					
1. *2 air T (°F) #1					
32. *2 air T (°F) #2					
33. *2 air T (°F) #3					
34. Stack T (°F)	779	776	775	785	
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	70	70	70	80%	
37. Bottom Furnace P (iwg)	-0.20	+.04	-0.03	+.01	
38. Convective P (iwg)	-0.02	0	-0.01	+.0	
39. Stack P (iwg)	+ 0.02	0	+0.01	.0	
40. Air Registers (% open)	50	50	50	50	
41. Crude API Gravity	26.8	26.9	26.9	26.8	
42. Flame Observations	yellow tinge, long	→	→		
43. Other Observations	~~baseline~~	~~baseline~~	~~baseline~~	BASELINE	

UNIT OPERATING DATA

st No. 7/2 Date 6-13-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Natural Gas Capacity ~~18000~~ 16,350 bbl/d.

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: High LOAD, O_2 variations

1. Test Number	7/2-2	7/2-3	7/2-4		
2. Date	6-13	6-13	6-13		
3. Time	0937	1049	1112		
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.7	7.7	7.7		
6. Crude T_{in} (°F)	378	377	378		
7. Crude T_{out} (°F) East	641	649	647		
8. Crude T_{out} (°F) West	637	642	644		
9. Crude P_{in} (psig) East	140	180	180		
10. Crude P_{in} (psig) West	170	170	170		
11. Crude P_{out} (psig)	43	43.5	43.5		
12. Reabsorber gas in x 205.856 (10^3 scf/d)					
13. Natural gas in x 169.044 (10^3 scf/d)	6.2	6.05	6.4		
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	20.7	20.2	22		
17. Burner #2	20.2	20	21.5		
18. Burner #3	20.6	20	21.8		
19. Burner #4	20.6	20	21.8		
20. Burner #5	21.6	21	22.6		
21. Burner #6	21.3	20.8	22.4		

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UNIT OPERATING DATA - CONTINUED

Test No. 7/2 Date 6-13-80 Location ? Engr.

Unit No. 11 H13 Fuel NG Capacity 16,250

Unit Type Burner Type

Test Description:

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
.. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	790	757	791		
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	80	58	90		
37. Bottom Furnace P (iwg)	-0.15	+0.01	-0.01		
38. Convective P (iwg)	-0.11	+0.01	0		
39. Stack P (iwg)	-0.11	+.05	-0.14		
40. Air Registers (% open)	50	50	50		
41. Crude API Gravity	26.3	26.3	26.3		
42. Flame Observations	blue, turb	yellow, long flame	turb, long		
43. Other Observations	baseline	low O2	high O2		

UNIT OPERATING DATA

est No. 7/3 Date 6-13-80 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Natural Gas Capacity ~~[illegible]~~ 16,250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: Baseline, low load

1. Test Number	7/3-1	7/3-2	7/3-3	7/3-4	
2. Date	6-13	6-13	6-13	6-13	
3. Time	1419	1503	1537	1635	
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	4.5	4.5	4.5	4.5	
6. Crude T_{in} (°F)	421	421	422	424	
7. Crude T_{out} (°F) East	644	646	644	646	
8. Crude T_{out} (°F) West	646	645	644	642	
9. Crude P_{in} (psig) East	130	130	130	128	
10. Crude P_{in} (psig) West	120	120	120	120	
11. Crude P_{out} (psig)	30.5	30.5	31	31	
12. Reabsorber gas in x 205.856 (10^3 scf/d)					
13. Natural gas in x 169.044 (10^3 scf/d)	3.4	3.1	3.1	2.9	
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	7.5	6.4	6.2	5.6	
17. Burner #2	7	5.9	5.5	4.9	
18. Burner #3	7.6	6.6	6.3	6	
19. Burner #4	7.4	6.3	6.1	5.6	
20. Burner #5	8.4	7.	7.0	6.6	
21. Burner #6	8.2	7.3	7.0	6.4	

UNIT OPERATING DATA - CONTINUED

Test No. 7/3 Date 6-13-80 Location 7 Engr.

Unit No. 11 H 13 Fuel Capacity 16 250 bbl/d

Unit Type Burner Type

Test Description:

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
.. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	717	659	637	613	
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	60	41	38	33	
37. Bottom Furnace P (iwg)	0	+0.01	0	—	
38. Convective P (iwg)	+0.04	+0.03	+0.1	—	
39. Stack P (iwg)	+0.03	+0.03	+0.10	—	
40. Air Registers (% open)	50	50	50	50	
41. Crude API Gravity	26.3	26.3	26.3	26.3	
42. Flame Observations	blue, short	→ ditto	→	yellow tinge long, lazy	
43. Other Observations	high O_2	baseline	low O_2	min O_2	

UNIT OPERATING DATA

st No. 7/4-1 Date 6-16-80 Location 7 Engr. TIDONA
Unit No. 11H13 Fuel RESID. OIL/NAT. GAS Capacity ~~16000~~ 16250 bbl/day
Unit Type CRUDE HEATER Burner Type Zink DBA-22 (six)
Test Description: BASELINE → High O₂ | BASELINE CHECK | MED.-LO O₂

1. Test Number	7/4-1	7/4-1	7/4-2	7/4-3	7/4-4
2. Date	6-16-80	6-16-80	6-16-80	6-17-80	6-17-80
3. Time	14:28	16:00	16:57	11:10	12:32
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.20	6.20	6.20	6.20	6.20
6. Crude T_{in} (°F)	385	386	385	386	386
7. Crude T_{out} (°F) East	631	636	639	638	640
8. Crude T_{out} (°F) West	640	645	648	648	646
9. Crude P_{in} (psig) East	150	150	150	150	150
10. Crude P_{in} (psig) West	150	150	150	150	150
11. Crude P_{out} (psig)	37.5	37.5	38.0	37.5	37.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	0	0	0	0	0
13. Natural gas in x 169.044 (10^3 scf/d)	2.3	2.2	2.9	1.7	1.6
14. Fuel oil in ?					
Gas Burner P (psig) 15. Fuel P/steam P (psig)				5	5
16. Burner #1	33/48	33/48	33/48	33/48	34/49
17. Burner #2	28/48	28/48	28/49	28/49	28/49
18. Burner #3	27/45	27/45	27/45	27/46	28/46
19. Burner #4	27/42	27/43	27/42	28/43	27/43
20. Burner #5	28/43	28/43	28/43	28/44	28/44
21. Burner #6	27/34	27/34	28/35	28/35	28/35

UNIT OPERATING DATA - CONTINUED

Test No. 7/4-1 Date 6-16-80 Location ________ Engr. ________

Unit No. 11 H 13 Fuel ________ Capacity ________

Unit Type ________ Burner Type ________

Test Description: ________

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P°to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	716	717	742	712	696
35. Fuel Oil T (°F)	189	192	190	193	194
36. Stack Damper (% open)	58	58	68	51	49
37. Bottom Furnace P (iwg)	-0.18	-0.11	-0.24	-0.02 seems low	-0.01
38. Convective P (iwg)	+0.02	0.0	-0.09	+0.01	+0.01
39. Stack P (iwg)	-0.02	+0.01	-0.04	+0.01	+0.03
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	26.4	26.4	26.4	26.4	26.4
42. Flame Observations	Bushy Intense yellow		no change		lazier flame [illegible]
43. Other Observations	~1½' diam can't see top				

UNIT OPERATING DATA

est No. 7/4 Date 6-17-80 Location 7 Engr. Tidona, Hart
Unit No. 1H13 Fuel Oil + Nat Gas Capacity 16,250 bbl/d
Unit Type crude primary heater Burner Type Zink DBA-22
Test Description: baseline max- load

1. Test Number	7/4-5	7/5-1			
2. Date	6-17	6-17			
3. Time	1358				
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2				
6. Crude T_{in} (°F)	386				
7. Crude T_{out} (°F) East	638				
8. Crude T_{out} (°F) West	638				
9. Crude P_{in} (psig) East	155				
10. Crude P_{in} (psig) West	150				
11. Crude P_{out} (psig)	37.5				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	0.0				
13. Natural gas in x 169.044 (10^3 scf/d) or Fuel gas	[illegible] 1.6				
14. Fuel oil in tank level	9'5 3/8"				
15. Fuel P/steam P (psig)	gas P~4.5				
16. Burner #1	33/49				
17. Burner #2	28/49				
18. Burner #3	27/46				
19. Burner #4	27/42				
20. Burner #5	28/43				
21. Burner #6	28/36				

UNIT OPERATING DATA - CONTINUED

Test No. 7/4 Date 6-17-80 Location 7 Engr.

Unit No. 11 H 13 Fuel Capacity 16,250

Unit Type Burner Type

Test Description:

22. °2 air flow total P	7/4-5				
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
.. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	675				
35. Fuel Oil T (°F)	195				
36. Stack Damper (% open)	46				
37. Bottom Furnace P (iwg)	-0.02				
38. Convective P (iwg)	-0.01				
39. Stack P (iwg)	-0.01				
40. Air Registers (% open)	50				
41. Crude API Gravity	26.4				
42. Flame Observations	dull yellow				
43. Other Observations	CO limit				

UNIT OPERATING DATA

st No. 7/5 Date 6-18 Location 7 Engr. Tidona, Hart
Unit No. 11413 Fuel Resid oil/natl gas Capacity 16,250 ~~18000~~ BBL/D
Unit Type process crude heater Burner Type Zink DBA-22
Test Description: Baseline - high load

1. Test Number	7/5-1	7/5-2	7/5-3	7/5-4	
2. Date	6-18	6-18	6-18	6-18	
3. Time	1048	1137	1215	1507	
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.78	7.78	7.78	7.78	
6. Crude T_{in} (°F)	364	365	365	368	
7. Crude T_{out} (°F) East	639	638	641	658	
8. Crude T_{out} (°F) West	650	652	650	661	
9. Crude P_{in} (psig) East	170	170	170	175	
10. Crude P_{in} (psig) West	164	164	164	170	
11. Crude P_{out} (psig)	43.5	43.5	43.5	44.0	
12. Reabsorber gas in x 205.856 (10^3 scf/d)	—	—	—	—	
13. Natural gas in x 169.044 (10^3 scf/d)	3.5	3.6	3.6	3.5	@ 1441
14. Fuel oil in	7'1½"/	7'0¾"/	7'0⅝"/	7'9⅜"/	7'1⅜"/
15. Fuel P/steam P (psig)	Gas ~ 10	Gas ~ 10	Gas ~ 10	Gas ~ 10	
16. Burner #1	34 / 48	33/ 48	33/ 48	33/ 48	
17. Burner #2	28/ 49	28/49	28/49	28/ 48	
18. Burner #3	27/ 46	27/46	27/46	27/ 45	
19. Burner #4	28/ 44	28 /44	28/44	27/ 44	
20. Burner #5	28/ 44	28/44	28/43	28/ 43	
21. Burner #6	29/34	29 /34	29 /35	28 / 35	

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UNIT OPERATING DATA - CONTINUED

Test No. 7/5 Date 6-18 Location 7 Engr.

Unit No. 11 #13 Fuel Capacity

Unit Type Burner Type

Test Description:

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
31. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	776	771	762	784	
35. Fuel Oil T (°F)	196	197	197	200	
36. Stack Damper (% open)	70	65	64	90	
37. Bottom Furnace P (iwg)	[illegible] working	-.15	-0.18	-.23	
38. Convective P (iwg)	on	-0.09	-0.05	-.16	
39. Stack P (iwg)	manometer	7+.15	-0.05	-.12	
40. Air Registers (% open)	50	50	50	50	
41. Crude API Gravity	26.0	26.0	26.0	26.0	
42. Flame Observations	–	slightly smoky	very bushy, long	brighter, short	
43. Other Observations	load brought up on gas	pressure			

UNIT OPERATING DATA

t No. 7/6 Date 6-19-80 Location 7 Engr. Tidona, Hert

Unit No. 11H13 Fuel Resid Oil + Nat. Gas Capacity 16280 bbl/d

Unit Type Crude process heater Burner Type Zink DBA-22

Test Description: low load, Baseline

1. Test Number	7/6-1	7/6-2	7/6-3	7/6-4	
2. Date	6-19	6-19	6-19	6-19	
3. Time	0946	1110	1325	1420	
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	4.5	4.5	4.5	4.5	
6. Crude T_{in} (°F)	420	421	420	421	
7. Crude T_{out} (°F) East	645	646	648	649	
8. Crude T_{out} (°F) West	648	646	650	647	
9. Crude P_{in} (psig) East	130	128	128	128	
10. Crude P_{in} (psig) West	120	120	120	120	
11. Crude P_{out} (psig)	31	31	30.5	30.75	
12. Reabsorber gas in x 205.856 (10^3 scf/d)	~~0.5~~ 0	~~0.5~~ 0	~~0.5~~ 0	~~0.7~~ 0	
13. Natural gas in x 169.044 (10^3 scf/d)	2.0	1.8	1.9	1.6	
14. Fuel oil in	tank not blocked off				
15. Fuel P/steam P (psig) Atom' [illegible] -burn	33-4.5	reg - 4.3 33-3.5			
16. Burner #1	17/34	18/33	18/34	18/35	
17. Burner #2	→13/35	13/35	13/35	13/35	
18. Burner #3	12/36	12/36	12/36	12/36	
19. Burner #4	12/34	12/34	12/34	13/34	
20. Burner #5	19/30	19/30	19/30	19/31	
21. Burner #6	13/22	12/22	13/22	13/22	

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/6 Date 6/19 Location 7 Engr. ____

Unit No. 11 H 13 Fuel ____ Capacity ____

Unit Type ____ Burner Type ____

Test Description: ____

22. *2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. *2 air damper, % open					
. *2 air T (°F) #1					
32. *2 air T (°F) #2					
33. *2 air T (°F) #3					
34. Stack T (°F)	723	660	629	614	
35. Fuel Oil T (°F)	-	-	-	196	
36. Stack Damper (% open)	60	40	35	31	
37. Bottom Furnace P (iwg)	-.41	-	-.07	-0.10	
38. Convective P (iwg)	-.04	-	>+0.2	>+0.2	
39. Stack P (iwg)	0	-	>+0.2	>+0.2	
40. Air Registers (% open)	50	50	50	50	
41. Crude API Gravity	26.0	26.0	26.0	26.0	
42. Flame Observations	#2 burner ~ ½ size of others	lo flow, bushy	smoky, dull	1 burner #5, more smoky -	
43. Other Observations	high O_2	baseline	low O_2	min O_2	

Page 3

UNIT OPERATING DATA **Test No.**______

Test No. 7/6- **Date** 6-19-80 **Location** 7 **Engr.**______

Unit No. 11H13 **Fuel** Ref. Gas/No. 6 Oil **Capacity**______

Unit Type Crude Htr. **Burner Type** Zink DBA-22

1. Test Number		7/6-2	7/6-3	7/6-4	
2. Date					
3. Time		1110	1325	1420	
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr. P (psig)		33	33	33	
9. Fuel Gas Brn. Man. P (psig)		3.5	3.5	3.75	
10. Fuel Gas Control Valve, % open		9.3 psig	Same → 42 %(?)	9.3	
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open		3.8 psig	Same → 30 (?)	3.9	
13. Oil Valve Inlet P (psig)		130	127	126	
14. Oil Valve Outlet P (psig)		18	18	18	
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/7 Date 6-20-80 Location 7 Engr. Hart, Tidona

Unit No. 11H13 Fuel #6 oil + Nat Gas Capacity 16250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: high load, same % oil/gas as med. & low loads

1. Test Number	7/7-1	7/7-2	7/7-3		
2. Date	6-20	6-20	6-20		
3. Time	953	1045	1135		
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.7	7.7	7.7		
6. Crude T_{in} (°F)	368	368	367		
7. Crude T_{out} (°F) East	643	641	642		
8. Crude T_{out} (°F) West	649	651	654		
9. Crude P_{in} (psig) East	178	172	171		
Crude P_{in} (psig) West	172	170	172		
11. Crude P_{out} (psig)	44	44	44		
12. Reabsorber gas in x 205.856 (10^3 scf/d)	–	–	–		
13. Natural gas in x 169.044 (10^3 scf/d)	2.9	3.0	3.0		
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	46/59	46/59	46/59		
17. Burner #2	40/60	40/60	40/59		
18. Burner #3	40/56	39/56	39/56		
19. Burner #4	40/46	40/46	40/47		
20. Burner #5	42/54	42/52	41/52		
21. Burner #6	42/46	42/46	41/46		

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/7 Date 6-20-80 Location 7 Engr.

unit No. 11 H13 Fuel Capacity

Unit Type Burner Type

Test Description:

	7/7-1				
22. *2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. *2 air damper, % open					
.. *2 air T (°F) #1					
32. *2 air T (°F) #2					
33. *2 air T (°F) #3					
34. Stack T (°F)	783	773	758		
35. Fuel Oil T (°F)		192	192		
36. Stack Damper (% open)	80	70	65		
37. Bottom Furnace P (iwg)	-.54	-.51	-.48		
38. Convective P (iwg)	-.15	-.11	-.09		
39. Stack P (iwg)	-.14	-.09	-0.04		
40. Air Registers (% open)	50	50	50		
41. Crude API Gravity	26.0	26.0	26.0		
42. Flame Observations	long, dull	long, slightly sooty	sooty around edges of heater		
43. Other Observations	hi O_2	baseline	low O_2		

Page 3

UNIT OPERATING DATA

Test No. 7/7

Test No. 7/7 **Date** 6-20-90 **Location** 7 **Engr.** ________

Unit No. 11 H 13 **Fuel** ________ **Capacity** ________

Unit Type ________ **Burner Type** ________

1. Test Number	7/7-1	7/7-2	7/7-3		
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level	10'10 7/16" at 1010	10' 5/16" at 1100	10'8 7/8" at 1143		
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)	32.5	32.5	32.5		
9. Fuel Gas Brn Man. P (psig)	7	8	7.5		
10. Fuel Gas Control Valve, % open	9.2 psi	9.5	9.4		
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	6.9 psi	6.2	6.0		
13. Oil Valve Inlet P (psig)	122	122	123		
14. Oil Valve Outlet P (psig)	46	46	46		
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7-8 Date 6-20-80 Location 7 Engr. Tidona, Hall

Unit No. 11H13 Fuel Gas Capacity 16,250 bbl/d

Unit Type heater Burner Type Zink DBA-22

Test Description: — steaming (H2O injection), #2 air off

1. Test Number	✓ steaming oil guns -	Baseline	#2 air off		
2. Date	6-20	6-20	6-20		
3. Time	1415	1525	1545		
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2		
6. Crude T_{in} (°F)	388	372	388		
7. Crude T_{out} (°F) East	647	648	646		
8. Crude T_{out} (°F) West	647	643	646		
9. Crude P_{in} (psig) East	158		150		
10. Crude P_{in} (psig) West	170		165		
11. Crude P_{out} (psig)	?	?	38.5		
12. Reabsorber gas in x 205.856 (10^3 scf/d)	—	—	—		
13. Natural gas in x 169.044 (10^3 scf/d)	3.9	3.7	3.75		
14. Fuel oil in					
15. Fuel P/steam P (psig)	1 ..				
16. Burner #1	166				
17. Burner #2	166				
18. Burner #3	162				
19. Burner #4	152				
20. Burner #5	158				
21. Burner #6	152				
	7/8-1	7/8-2	7/8-3		

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/8 Date 6/20 Location 7 Engr. ________

Unit No. 11 H13 Fuel ________ Capacity ________

Unit Type ________ Burner Type ________

Test Description: ________

22. °2 air flow total P	7/8-1	7/8-2	7/8-3		
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
.. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	761	773	727		
35. Fuel Oil T (°F)	-	-			
36. Stack Damper (% open)	70	50	60		
37. Bottom Furnace P (iwg)	-.11				
38. Convective P (iwg)	-.09				
39. Stack P (iwg)	-.04				
40. Air Registers (% open)	50	50	~5%		
41. Crude API Gravity	26.0	26.0	26.0		
42. Flame Observations	clear, blue	slight yellow tinge	blue at base rest yellow		
43. Other Observations	steaming				

Page 3

UNIT OPERATING DATA

Test No. 7/8

Test No. 7/8 **Date** 6-20 **Location**______ **Engr.**______

Unit No. 11 H 13 **Fuel**______ **Capacity**______

Unit Type______ **Burner Type**______

1. Test Number	7/8-1	7/8-2	7/8-3		
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. Gas Header	32.5	32.5	32.5		
7. Gas Manifold	12.5	11.5	11		
8. Steam Header	67				
9. gas valve % open psig	9.2	8.8	8.8		
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

rt No. 7/9 Date 6-24-80/6-25 Location 7 Engr. Tidona, Hart

Unit No. 11H13 Fuel Reabsorber Gas Capacity 16,250 bbl/day

Unit Type CRUDE HTR. Burner Type ZINK DBA-22

Test Description: BASELINE Baseline

1. Test Number	7/9-1	7/9-2	7/9-1	7/9-2	7/9-3
2. Date	6-24-80	6-24	6-25	6-25	6-25
3. Time	13:47	1525	920	11 50	1240
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	393	393	391	393	393
7. Crude T_{out} (°F) East	649	649	650	649	649
8. Crude T_{out} (°F) West	646	648	647	649	651
9. Crude P_{in} (psig) East	155	160	155	158	158
10. Crude P_{in} (psig) West	150	160	160	160	150
11. Crude P_{out} (psig)	36.5	36.5	36.5	36.5	36.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.65	3.6	3.5	3.6	3.6
13. Natural gas in x 169.044 (10^3 scf/d)	0	—	—		
14. Fuel oil in	NONE	—	—		
15. Fuel P/steam P (psig)					
16. Burner #1	10.1	10.2	10.1	10.7	10.7
17. Burner #2	10.0	10.	10.	10.	10.
18. Burner #3	10.4	10.5	10.5	10.8	10.8
19. Burner #4	10.0	10.3	10.2	10.6	10.5
20. Burner #5	11.0	11.2	11.1	11.5	11.3
21. Burner #6	11.0	11.0	11.1	11.5	11.3

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/9 Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

22. *2 air flow total ΔP in	NONE	[illegible] 1.9/1674 [illegible]		1.9 in. [illegible] .78 psi/1655	2.2 in [illegible] 2077
23. P to Burner #1		12.75 %/		.95/	.9/
24. P to Burner #2		12.75 %/		.95/	/
25. P to Burner #3		0.5 psig/		.95/	/
26. P to Burner #4		0.5 psig/		.95/	/
27. P to Burner #5		0.5 psig/		.95/	/
28. P to Burner #6		0.5 psig/		.95/	/
29. Staging height (ft)	-0-	4.0		4.0	4.0
30. *2 air damper, % open	5 9	4/9		3.5/9	5.5/9
*2 air T (°F) #1 North		320		345	306
32. *2 air T (°F) #2 South		249		250	225
33. *2 air T (°F) #3 Skin		443		423°	383
34. Stack T (°F)	734	732	737	742	742
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	60	55	60	55	55
37. Bottom Furnace P (iwg)	-0.40	-.29	-.44	-.34	-.31
38. Convective P (iwg)	-0.02	-.04	-.04	+.05	+.07
39. Stack P (iwg)	+0.04	-.03	+0.04	+.12	+.14
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	25.4	25.4	25.4	25.4	25.4
42. Flame Observations	Yellow tops Blue bases			flame shifting - some [illegible] in	
43. Other Observations	Steady			the flame : [illegible]	

UNIT OPERATING DATA

t No. 7/9 Date 6-25-80/6-26 Location 7 Engr. HART, T. Dean

Unit No. 11H13 Fuel Reabsorb. Gas Capacity 16250 bbl/d

Unit Type Crude process heater Burner Type Zink DBA-22

Test Description: Staged Air Baseline Baseline, 4% Excess O2 2%

1. Test Number	7/9-4	7/9-1	7/9-1	7/9-5	7/9-6
2. Date	6-25	6-25	6-26	6-26	6-26
3. Time	1355	1525	735	850	921
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	383	383	388	388	389
7. Crude T_{out} (°F) East	646	652	651	652	649
8. Crude T_{out} (°F) West	651	649	649	646	647
9. Crude P_{in} (psig) East	158	—	158	158	160
10. Crude P_{in} (psig) West	150	—	150	150	150
11. Crude P_{out} (psig)	36.5	—	36.8	37.5	37.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.5	3.5	3.5	3.5	3.45
13. Natural gas in x 169.044 (10^3 scf/d)	–				
14. Fuel oil in	–				
15. Fuel P/steam P (psig)					
16. Burner #1	10.4	~10	10.8	10	10.2
17. Burner #2	10.	"	10	10.	10.
18. Burner #3	10.5	"	10.9	10.3	10.2
19. Burner #4	10.3	"	10.6	10.2	10.0
20. Burner #5	11.2	"	11.4	10.8	10.8
21. Burner #6	11.	"	11.5	10.9	10.8

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/9 Date 6-25-80 Location 7 Engr.

Unit No. Fuel Capacity

Unit Type Burner Type

Test Description:

22. °2 air flow total P acfm	[illegible] =1.85/ 2470				1.80 .95/ 1850
23. P to Burner #1 psig	.95 psi/				.95/
24. P to Burner #2	.95/				.95/
25. P to Burner #3	.95/				/
26. P to Burner #4	.95/				/
27. P to Burner #5	.95/				/
28. P to Burner #6	.95/				/
29. Staging height (ft)	4				4
30. °2 air damper, % open	9/9				3.5/9
°2 air T (°F) #1 North	280				324
32. °2 air T (°F) #2 South	215				260
33. °2 air T (°F) #3 skin	366				430
34. Stack T (°F)	728	740	743	702	716
35. Fuel Oil T (°F)	—	—	—		
36. Stack Damper (% open)	51	60	60	49	49
37. Bottom Furnace P (iwg)	-.26	—	-.48	-.34	-.25
38. Convective P (iwg)	+.11	—	-.18	+.05	+.13
39. Stack P (iwg)	>+.17	—	-.02	+.13	<+.18
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	25.1	25.1	25.7	25.7	25.7
42. Flame Observations	#2 burner blew			blue	more yellow(s)
43. Other Observations	operator to have it cleaned	baseline	baseline 4%	baseline, [illegible]	oxygen swing [illegible]

UNIT OPERATING DATA

Test No. 7/9 Date 6-26-80 Location 7 Engr. Hart, T Dona

Unit No. 11H13 Fuel Reab. Gas Capacity 16250 bbl/d

Unit Type Crude process heater Burner Type Zink DBA-22

Test Description:

1. Test Number	7/9-7	7/9-8				
2. Date	6-26	6-26				
3. Time	1010	1055				
4. Load x 10^6 Btu/hr						
5. Process Rate x 1847.7 bbl/d	6.2	6.2				
6. Crude T_{in} (°F)	391	392				
7. Crude T_{out} (°F) East	649	647				
8. Crude T_{out} (°F) West	650	650				
9. Crude P_{in} (psig) East	155	155				
10. Crude P_{in} (psig) West	150	150				
11. Crude P_{out} (psig)	37.5	37.5				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.4	3.4				
13. Natural gas in x 169.044 (10^3 scf/d)	–	–				
14. Fuel oil in	–	–				
15. Fuel P/steam P (psig)	–	–				
16. Burner #1	10.1	10.2				
17. Burner #2	10.	10.				
18. Burner #3	10.	10.2				
19. Burner #4	9.9	10.				
20. Burner #5	10.8	10.8				
21. Burner #6	10.7	11.				

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UNIT OPERATING DATA - CONTINUED

Test No. 7/9 Date 1-26 Location 7 Engr. HART

Unit No.______ Fuel______ Capacity______

Unit Type______ Burner Type______

Test Description:______

22. °2 air flow total P	2.7(0) [illegible] 2070	22 1.35 / 2448			
23. P to Burner #1 psig(?)	0.7/	.95/			
24. P to Burner #2	/				
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)	4	4			
30. °2 air damper, % open	5.5/9	9/9			
1. °2 air T (°F) #1 North	284	261			
32. °2 air T (°F) #2 South	233	216			
33. °2 air T (°F) #3 Skin	398	358			
34. Stack T (°F)	709	705			
35. Fuel Oil T (°F)	—	—			
36. Stack Damper (% open)	48	47			
37. Bottom Furnace P (iwg)	-.22	-.19			
38. Convective P (iwg)	+.16	+.18			
39. Stack P (iwg)	~+.20	>+.22			
40. Air Registers (% open)	50	50			
41. Crude API Gravity	25.7	25.7			
42. Flame Observations	very yellow	very yellow smoky at bottom			
43. Other Observations	Burner #2 almost out.				

UNIT OPERATING DATA

Test No. 7/10 Date 6-26-80 Location 7 Engr. HART, TIDONA

Unit No. 11H13 Fuel Reab. Gas Capacity 16250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: Baseline | Staging at 3 ft.

		low staging	med. staging	high staging	baseline
1. Test Number	7/10 - 1	7/10-2	7/10-3	7/10-4	7/10-1
2. Date	6-26	6-26	6-26	6-26	6-26
3. Time	1310	1345	1420	1450	1520
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	392	392	393	392	394
7. Crude T_{out} (°F) East	651	649	648	650	650
8. Crude T_{out} (°F) West	648	650	652	649	648
9. Crude P_{in} (psig) East	155	158	158	156	156
10. Crude P_{in} (psig) West	150	150	150	150	150
11. Crude P_{out} (psig)	37.5	37.8	37.8	37.8	37.8
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.55	3.6	3.6	3.6	3.55
13. Natural gas in x 169.044 (10^3 scf/d)	—	–	—	–	–
14. Fuel oil in	—	–	–	–	–
15. Fuel P/steam P (psig)		–	—	–	—
16. Burner #1	10.6	11.	10.7	10.6	10.8
17. Burner #2	10.	10.3	10.2	10.2	10.3
18. Burner #3	10.6	11.2	10.8	11.1	11.1
19. Burner #4	10.4	11.0	10.6	10.7	10.8
20. Burner #5	11.3	12.	11.5	11.5	11.5
21. Burner #6	11.3	11.6	11.5	11.5	11.6

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UNIT OPERATING DATA - CONTINUED

Test No. 7/10 Date 6-26-80 Location 7 Engr. Hart, Tidona

Unit No. 11H13 Fuel Refy. Gas Capacity 16250 bbl/d

Unit Type Crude heater Burner Type Zink DBA-22

Test Description: Staged air, 3 ft

					baseline
22. °2 air flow total P (N) iwg (S) psig		1.4 (N) 0.9 (S) / 1667	2.2 1.0 / 2094	3.1 1.5 / 2481	/
23. P to Burner #1 P psig (S)		0.4 /	0.65 /	0.95 /	/
24. P to Burner #2		"	"		
25. P to Burner #3		"	"		
26. P to Burner #4		"	"		
27. P to Burner #5		"	"		
28. P to Burner #6		"	"		
29. Staging height (ft)		3	3	3	
30. °2 air damper, % open		3.5/9	5.5/9	9/9	
. °2 air T (°F) #1 N		268	244	220	
32. °2 air T (°F) #2 S		200	185	174	
33. °2 air T (°F) #3 Skin		404	360	342	
34. Stack T (°F)	743	750	749	743	747
35. Fuel Oil T (°F)	—	—	—	—	
36. Stack Damper (% open)	63	59	57	55	62
37. Bottom Furnace P (iwg)	-.50	-.39	-.34	-.29	-.47
38. Convective P (iwg)	-.10	+.01	+.03	+.09	-.11
39. Stack P (iwg)	-.04	+.06	+.08	+.14	-.04
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	25.7	25.7	25.7	25.7	25.7
42. Flame Observations	blue, "thin"	slightly more yellow, longer	even more yell & longer	even more!	not as yellow
43. Other Observations				#2 burner off? low flow, blue	

UNIT OPERATING DATA

st No. 7/10 Date 6-27-80 Location 7 Engr. Tidona, Hunt

Unit No. 11H13 Fuel Refy. Gas Capacity 16250 bbl/d

Unit Type crude heater Burner Type Zink DBA-22

Test Description: Baseline 4% Baseline 2% Staging 3 ft @ 2% O_2

1. Test Number	7/10-5	7/10-6	low staging 7/10-7	med. staging 7/10-8	high staging 7/10-9
2. Date	6-27	6-27	6-27	6-27	6-27
3. Time	925	925	1005	1055	1130
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	390	390	392	393	393
7. Crude T_{out} (°F) East	652	651	652	653	654
8. Crude T_{out} (°F) West	649	648	649	652	653
9. Crude P_{in} (psig) East	157	160	159	158	158
10. Crude P_{in} (psig) West	150	151	150	150	150
11. Crude P_{out} (psig)	37.8	39.2	39.	39.	39.
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.6	3.5	3.2	3.2	3.5
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	—	—
14. Fuel oil in	—	—	—	—	—
15. Fuel P/steam P (psig)	—	—	—	—	—
16. Burner #1	10.9	10.2	10.4	10.1	10.1
17. Burner #2	10.2	10.2	10.	10.1	10.1
18. Burner #3	11.2	10.4	10.6	10.4	10.8
19. Burner #4	11.0	10.3	10.4	10.1	10
20. Burner #5	11.7	11.1	11.3	11.	11
21. Burner #6	11.6	10.9	11.3	10.8	11

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UNIT OPERATING DATA - CONTINUED

Test No. 7/10 Date 8-27-80 Location 7 Engr. HART

Unit No. 11H13 Fuel Ref. Gas Capacity 16250 BBL/D

Unit Type Heater Burner Type DBA-22

Test Description: Staging @ 3 ft.

22. °2 air flow total P √(iwg) s/(psig)			1.4 .67 / 1663	2.2 1.05 / 2086	3.2 1.5 / 2616
23. P to Burner #1 S (psig) @ 6			.45/	0.7/	.95/
24. P to Burner #2			"	"	"
25. P to Burner #3			"	"	"
26. P to Burner #4			"	"	"
27. P to Burner #5			"	"	"
28. P to Burner #6			"	"	"
29. Staging height (ft)			3	3	3
30. °2 air damper, % open			3.5/9	5.5/9	9/9
31. °2 air T (°F) #1 N			289	261	238
32. °2 air T (°F) #2 S			174	161	176
33. °2 air T (°F) #3 Skin			385	357	309
34. Stack T (°F)	740	709	718	712	713
35. Fuel Oil T (°F)	—	—	—	—	—
36. Stack Damper (% open)	60	49	48	47	47
37. Bottom Furnace P (iwg)	-.49	-.36	-.27	-.23	-.20
38. Convective P (iwg)	-.11	+.03	+.11	+.15	>+.17
39. Stack P (iwg)	-.03	+.09	+.18	+.20	>+.23
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	25.7	25.7	25.7	25.7	25.7
42. Flame Observations	thin, blue at base	-			yellow, bushy
43. Other Observations		2% baseline			

UNIT OPERATING DATA

st No. 7/10 Date 6-27-80 Location 7 Engr. Hart, Tidona

Unit No. 11H13 Fuel Reabsorber Gas Capacity 16,250 bbl/d

Unit Type heater, crude Burner Type Zink DBA-22

Test Description: Baseline 2.2

1. Test Number	7/10-6				
2. Date	6-27				
3. Time	1215				
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2				
6. Crude T_{in} (°F)	394				
7. Crude T_{out} (°F) East	649				
8. Crude T_{out} (°F) West	646				
9. Crude P_{in} (psig) East	158				
10. Crude P_{in} (psig) West	150				
11. Crude P_{out} (psig)	39.				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.2				
13. Natural gas in x 169.044 (10^3 scf/d)	—				
14. Fuel oil in	—				
15. Fuel P/steam P (psig)	—				
16. Burner #1	10.2				
17. Burner #2	10.				
18. Burner #3	10.2				
19. Burner #4	10.3				
20. Burner #5	11.1				
21. Burner #6	11.1				

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UNIT OPERATING DATA - CONTINUED

Test No. 7/10 Date 6-27 Location 7 Engr. AART

Unit No. 11H13 Fuel Refi. Gas Capacity 16250 bbl/d

Unit Type heater Burner Type DBA-22

Test Description: 2% baseline

22. *2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. *2 air damper, % open					
. *2 air T (°F) #1					
32. *2 air T (°F) #2					
33. *2 air T (°F) #3					
34. Stack T (°F)	710				
35. Fuel Oil T (°F)	—				
36. Stack Damper (% open)	52				
37. Bottom Furnace P (iwg)	-.46				
38. Convective P (iwg)	+.02				
39. Stack P (iwg)	+.10				
40. Air Registers (% open)	50				
41. Crude API Gravity	25.7				
42. Flame Observations	Blue at base				
43. Other Observations					

UNIT OPERATING DATA

:t No. 7/11 Date 6-30-80 Location 7 Engr. Tidona

Unit No. 11H13 Fuel ADSORBER (REAB. + DEPROP.) Capacity 16,250 bbl/d

Unit Type CRUDE HTR Burner Type ZINK DB4-22

Test Description:	BASELINE	2 stage ht. low stage	med. stage	high stage	BASELINE
1. Test Number	7/11-1	7/11-2	7/11-3	7/11-4	7/11-5
2. Date	6-30-80	6-30-80	6-30-80	6-30-80	6-30-80
3. Time	08:22	09:48	10:48	11:25	13:55
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	394	392	394	392	392
7. Crude T_{out} (°F) East	645	640	637	638	646
8. Crude T_{out} (°F) West	644	648	648	651	643
9. Crude P_{in} (psig) East	150	150	150	150	150
10. Crude P_{in} (psig) West	150	150	150	150	150
11. Crude P_{out} (psig)	37.5	38.0	38.0	38.0	37.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.4	3.4	3.4	3.4	3.4
13. Natural gas in x 169.044 (10^3 scf/d)	0	0	0	0	0
14. Fuel oil in	NONE	NONE	NONE	NONE	NONE
15. Fuel P/steam P (psig)					
16. Burner #1	10.2	10.0	10.4	10.6	10.2
17. Burner #2	9.9	10.0	10.0	10.0	10.0
18. Burner #3	10.2	10.2	10.8	10.9	10.3
19. Burner #4	10.0	10.0	10.4	10.4	10.0
20. Burner #5	11.0	10.9	11.3	11.5	11.0
21. Burner #6	11.1	10.8	11.3	11.5	11.0
	4% O_2	4% O_2	4% O_2	4% O_2	4% O_2

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/11 Date 6 30 Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

22. °2 air flow total P, in H2O (scfm)		0.7 [illegible] 1.4 (1673 cfm)	1.0 2.2 (2101)	1.45 3.1 (2492)	
23. P to Burner #1 (psi)		0.4	0.6	0.7	
24. P to Burner #2 "		0.4	"	"	
25. P to Burner #3 "		0.4	"	"	
26. P to Burner #4 "		0.4	"	"	
27. P to Burner #5 "		0.4	"	"	
28. P to Burner #6 "		0.4	"	"	
29. Staging height (ft)		2	2	2	
30. °2 air damper, % open		3.5/9	5.5/9	100	
31. °2 air T (°F) #1 (skin temp)		323	281	243	
32. °2 air T (°F) #2 (S)		159	148	142	
33. °2 air T (°F) #3 (W)		245	219	205	
34. Stack T (°F)	730	720	731	730	733
35. Fuel Oil T (°F)	—	—	—	—	—
36. Stack Damper (% open)	58	54	54	53	61
37. Bottom Furnace P (iwg)	-0.45	-0.31	-0.32	-0.30	-0.44
38. Convective P (iwg)	-0.06	+0.06	+0.05	+0.07	-0.08
39. Stack P (iwg)	-0.01	+0.12	+0.08	+0.06 (?)	0.0
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	26.1	26.1	26.1	26.1	26.1
42. Flame Observations	Blue at base	No. 2 flame not	flames are shorter, bushier	→	
43. Other Observations	Yellow above	as yellow, smaller than others	some load fluctuation	→	

UNIT OPERATING DATA

Test No. 7/11 Date 6-30-80 Location 7 Engr. Tidona

Unit No. 11H13 Fuel ADSORBER GAS Capacity 16250 bbl/d

Unit Type CRUDE HTR Burner Type ZINK DBA 22

Test Description: No Staging 2% O2 No Staging Med. S.A. Hi. S.A 4' Stage Ht. Max. SA Repeat Basel

1. Test Number	7/11-5	7/11-6	7/11-7	7/11-8	7/11-9	7/11-1
2. Date	6-30-80	6-30-80	6-30-80	6-30-80	6-30-80	→
3. Time	15:05	15:45	16:10	17:06	17:33	18:15
4. Load x 10^6 Btu/hr						
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	393	392	392	392	391	391
7. Crude T_{out} (°F) East	646	641	642	641	645	643
8. Crude T_{out} (°F) West	644	647	650	645	642	642
9. Crude P_{in} (psig) East	150	150	150	150	150	150
10. Crude P_{in} (psig) West	150	150	150	150	150	150
11. Crude P_{out} (psig)	37.5	37.5	37.5	37.5	37.5	37.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.4	3.4	3.4	3.4	3.4	3.4
13. Natural gas in x 169.044 (10^3 scf/d)	0	0	0	0	0	0
14. Fuel oil in	NONE	NONE	NONE	NONE	NONE	–
15. Fuel P/steam P (psig)						
16. Burner #1	9.6	9.6	9.8	9.6	9.6	9.9
17. Burner #2	9.6	9.6	9.7	9.6	9.3	9.9
18. Burner #3	9.9	9.9	10.0	9.8	9.8	10.0
19. Burner #4	9.8	9.6	9.8	9.8	9.5	10.0
20. Burner #5	10.6	10.6	10.7	10.5	10.4	10.8
21. Burner #6	10.6	10.5	10.6	10.5	10.4	10.8

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

						7/11-1
22. °2 air flow total P		0.65 1.4 (1685)	1.1 2.2 (2108)	1.45 3.0 (2455)	⟶	0
23. P to Burner #1		0.40	0.70	0.95	0.95	0
24. P to Burner #2		"	"	"	"	0
25. P to Burner #3		"	"	"	"	0
26. P to Burner #4		"	"	"	"	0
27. P to Burner #5		"	"	"	"	0
28. P to Burner #6		"	"	"	"	0
29. Staging height (ft)		2	2	2	4	—
30. °2 air damper, % open		3.5/9	5.5/9	100	100	—
31. °2 air T (°F) #1 (skin)		354	324	275	402	—
32. °2 air T (°F) #2 (S)		167	154	143	226	—
33. °2 air T (°F) #3 (N)		249	220	209	287	—
34. Stack T (°F)	710	704	704	699	699	726
35. Fuel Oil T (°F)	—	—	—	—	—	
36. Stack Damper (% open)	53	48	48	49	50	60
37. Bottom Furnace P (iwg)	-0.35	-0.24	-0.22	-0.20	-0.18	-0.44
38. Convective P (iwg)	+0.01	+0.12	+0.14	+0.18	+0.19	-.05
39. Stack P (iwg)	+0.08	+0.11(?)	+0.15(?)	+0.17(?)	+0.18	-.06
40. Air Registers (% open)	50	50	50	50	50	50
41. Crude API Gravity	26.1	26.1	26.1	26.1	26.1	26.1
42. Flame Observations	good - little	⟶	flame getting	flame bushy,		
43. Other Observations	or no soot		shorter	billowy shorter		

UNIT OPERATING DATA

st No. 7/12 Date 7/1/80 Location 7 Engr. HART, TIDONA

Unit No. 11H13 Fuel Absorber Gas Capacity 16250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: low load baseline, low staging → → high staging

1. Test Number	7/12-1	7/12-2	7/12-3	7/12-4	7/12-5
2. Date	7/1	7/1	7/1	7/1	7/1
3. Time	955	935	1015	1040	1110
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	5.2	5.2	5.2	5.2	5.2
6. Crude T_{in} (°F)	409	399	391	392	394
7. Crude T_{out} (°F) East	642	637	649	649	647
8. Crude T_{out} (°F) West	640	635	648	645	642
9. Crude P_{in} (psig) East	140	140	140	140	140
10. Crude P_{in} (psig) West	134	135	132	130	130
11. Crude P_{out} (psig)	33.5	33.5	~32.	~32	31.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.6	2.7	2.8	2.8	2.8
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–	–	–
14. Fuel oil in	–	–	–	–	–
15. Fuel P/steam P (psig)	–	–	–	–	–
16. Burner #1	5.9	6.3	7.1	7.1	7.1
17. Burner #2	5.5	6.0	6.8	7.	6.8
18. Burner #3	6.3	6.7	7.4	7.3	7.3
19. Burner #4	6.1	6.3	7.1	7.2	7.2
20. Burner #5	6.9	7.2	8.1	8.2	8.1
21. Burner #6	6.9	7.2	7.8	8.2	8.0

UNIT OPERATING DATA - CONTINUED

Test No. 7/12 Date 7/1/80 Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

22. °2 air flow total P iwg (V) psig (S)		.7 .31/1183	1.9 .08/1673	2.2 .12/2095	3.0 .25/2445
23. P to Burner #1 psig (S)		.19	.31	.62/	.94/
24. P to Burner #2		"	-	"	"
25. P to Burner #3		"	-	-	"
26. P to Burner #4		"	-	-	"
27. P to Burner #5		"	"	"	"
28. P to Burner #6		"	-	-	-
29. Staging height (ft)		4	4	4	4
30. °2 air damper, % open		2.25/9	3.5/9	5.5/9	9/9
... °2 air T (°F) #1 N		283	315	435	260
32. °2 air T (°F) #2 S		371	248	228	210
33. °2 air T (°F) #3 Skin		504	451	296	402
34. Stack T (°F)	676	677	685	686	684
35. Fuel Oil T (°F)	—	—	—	—	—
36. Stack Damper (% open)	48	46	49	49	49
37. Bottom Furnace P (iwg)	-.28	-.21	-.22	-.20	-.18
38. Convective P (iwg)	-.04	+.13	+.12	+.15	+.20
39. Stack P (iwg)	+.01	+.20	?+.20	?+.20	+.25'
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	26.1	26.1	26.1	26.1	26.1
42. Flame Observations	blue at base	much more yellow & longer			
43. Other Observations	crude flows more erratic		when NO ↑ O_2 ↓ just opposite!		

UNIT OPERATING DATA

st No. 7/12 Date 7/1/80 Location 7 Engr. HART, TIDBALL

Unit No. 11H13 Fuel Adsorb. Gas Capacity 16250 bbl/d

Unit Type process crude heater Burner Type Zink DBA-22

Test Description: (2% O$_2$ baseline low staging med stg. high stg. very high stg. baseline 2%

1. Test Number	7/12-6	7/12-7	7/12-8	7/12-9	7/12-10
2. Date	7/1	7/1	7/1	7/1	7/1
3. Time	1225	1300	1330	1400	1443
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	5.2	5.2	5.2	5.2	5.2
6. Crude T_{in} (°F)	396	397	396	392	394
7. Crude T_{out} (°F) East	650	650	652	652	650
8. Crude T_{out} (°F) West	648	646	645	645	646
9. Crude P_{in} (psig) East	140	140	140	140	140
10. Crude P_{in} (psig) West	132	132	132	132	132
11. Crude P_{out} (psig)	32.	32.	32.	32.	32
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.75	2.7	2.7	2.75	2.75
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–	–	–
14. Fuel oil in	–	–	–	–	–
15. Fuel P/steam P (psig)	–	–	–	–	–
16. Burner #1	6.8	6.7	6.5	6.8	6.7
17. Burner #2	6.2	6.	6.	6.	6.
18. Burner #3	7.0	6.9	6.9	7.0	7.
19. Burner #4	6.7	6.5	6.5	6.8	6.6
20. Burner #5	7.6	7.5	7.4	7.8	7.5
21. Burner #6	7.6	7.4	7.3	7.7	7.4

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UNIT OPERATING DATA - CONTINUED

Test No. 7/12 Date 7/1 Location 7 Engr. HART

Unit No. ______ Fuel ______ Capacity ______

Unit Type ______ Burner Type ______

Test Description: ______

22. °2 air flow total P	.7 .27/ 1188	1.1 .53/ 1491	1.9 .81/ 1960	2.9 1.06/ 2207	
23. P to Burner #1	.25/	.31/	.50/	.69/	
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4		-			
27. P to Burner #5	-	-		-	
28. P to Burner #6	-	-		-	
29. Staging height (ft)	4	4	4	4	
30. °2 air damper, % open	2.5/9	3.5/9	4.5/9	5.5/9	
. °2 air T (°F) #1 N	377	351	436	200	
32. °2 air T (°F) #2 S	288	271	243	235	
33. °2 air T (°F) #3 stir	491	469	318	425	
34. Stack T (°F)	663	660	661	658	667
35. Fuel Oil T (°F)	—	—	—	—	—
36. Stack Damper (% open)	40	41	41	41	43
37. Bottom Furnace P (iwg)	-.19	-.16	-.15	-.13	-.26
38. Convective P (iwg)	~+.20	>+.2	>+.2	>+.2	+.10
39. Stack P (iwg)	~+.25	>+.2	>+.2	>+.2	+.15
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	26.1	26.1	26.1	26.1	26.1
42. Flame Observations	yellow, long	very smoky			
43. Other Observations	smoky				

UNIT OPERATING DATA

st No. 7/12 Date 7/1/80 Location 7 Engr. HART, T. DONA

Unit No. 11H13 Fuel Absorb. Gas Capacity 16 250 bbl/d

Unit Type process heater Burner Type Zink DBA-22

Test Description: baseline @ 4% O_2

1. Test Number	7/12-1 b				
2. Date	7/1/80				
3. Time	1457				
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	5.2				
6. Crude T_{in} (°F)	395				
7. Crude T_{out} (°F) East	651				
8. Crude T_{out} (°F) West	647				
9. Crude P_{in} (psig) East	140				
10. Crude P_{in} (psig) West	130				
11. Crude P_{out} (psig)	32				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.8				
13. Natural gas in x 169.044 (10^3 scf/d)	—				
14. Fuel oil in	—				
15. Fuel P/steam P (psig)	—				
16. Burner #1	7.1				
17. Burner #2	7.2				
18. Burner #3	7.2				
19. Burner #4	7.2				
20. Burner #5	8.0				
21. Burner #6	7.9				

UNIT OPERATING DATA - CONTINUED

Test No. 7/12 Date ______ Location ______ Engr. ______

Unit No. ______ Fuel ______ Capacity ______

Unit Type ______ Burner Type ______

Test Description: ______

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
1. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	692				
35. Fuel Oil T (°F)	—				
36. Stack Damper (% open)	55				
37. Bottom Furnace P (iwg)	-.36				
38. Convective P (iwg)	-.01				
39. Stack P (iwg)	+.06				
40. Air Registers (% open)	50				
41. Crude API Gravity	26.1				
42. Flame Observations					
43. Other Observations					

UNIT OPERATING DATA

st No. 7/13 Date 7/2/80 Location 7 Engr. HART, TIDONA

Unit No. 11H13 Fuel Absorber Gas Capacity 14250 bbl/d

Unit Type Crude process heater Burner Type Zink DEA-22

Test Description: Baseline

1. Test Number	7/13-1	7/13-2	7/13-3	7/13-4	7/13-5
2. Date	7/2	4ft	3 ft	2ft	1.5 ft
3. Time	800	900	920	1008	1028
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	376	374	375		
7. Crude T_{out} (°F) East	649	649	644		
8. Crude T_{out} (°F) West	642	646	647		
9. Crude P_{in} (psig) East	151	160	160		
10. Crude P_{in} (psig) West	148	160	160	1	
11. Crude P_{out} (psig)	35.5	36	36.5		
12. Reabsorber gas in x 205.856 (10^3 scf/d)	3.6	3.7	3.65		
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–		
14. Fuel oil in	–	–	–		
15. Fuel P/steam P (psig)	–	–	–		
16. Burner #1	11.0	11.6	11.6		
17. Burner #2	10.2	10.5	11.		
18. Burner #3	11.1	11.5	11.6		
19. Burner #4	11.0	11.8	11.8		
20. Burner #5	11.7	12.4	12.4		
21. Burner #6	11.8	12.3	12.3		

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UNIT OPERATING DATA - CONTINUED

Test No. 7/13 Date 7/2/80 Location 7 Engr. HART

Unit No. ____ Fuel ____ Capacity ____

Unit Type ____ Burner Type ____

Test Description: ____

22. *2 air flow total P		69 .75/1660	64 .75/1660	/1665	/1664
23. P to Burner #1		.46/	.46		
24. P to Burner #2		-			
25. P to Burner #3		-			
26. P to Burner #4		-			
27. P to Burner #5		-			
28. P to Burner #6		-			
29. Staging height (ft)		4	3	2	1.5
30. *2 air damper, % open		5.5/9	5.5/9	5.5/9	
.. *2 air T (°F) #1 N		312	256	208	181
32. *2 air T (°F) #2 S		252	196	148	121
33. *2 air T (°F) #3 Skin		432	365	319	225
34. Stack T (°F)	747	759	756		
35. Fuel Oil T (°F)	—	-	-	-	-
36. Stack Damper (% open)	64	62	62	62	62
37. Bottom Furnace P (iwg)	-.49	-.41	-.41		
38. Convective P (iwg)	-.10	0	-.01		
39. Stack P (iwg)	-.02	+.04	+.03		
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	26.6	26.6	26.6	26.6	26.6
42. Flame Observations		~ bright yellow			
43. Other Observations	slight breeze				

UNIT OPERATING DATA

st No. 7/14 Date 7-8-86 Location 7 Engr. HART

Unit No. 11H13 Fuel Resid Oil Capacity 16250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: baseline. ~2100 scfm, 4% O2, height variations

1. Test Number	7/14-1a	7/14-2	7/14-3	7/14-4	7/14-1b
2. Date	7-8	7-8	7-8	7-8	7-8
3. Time	915	1020	1105	1148	1220
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	379	380	380	381	381
7. Crude T_{out} (°F) East	648	652	656	656	652
8. Crude T_{out} (°F) West	644	639	635	636	639
9. Crude P_{in} (psig) East	155	153	153	153	153
10. Crude P_{in} (psig) West	150	150	150	150	150
11. Crude P_{out} (psig)	37.5	38.	37.5	37.5	37.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	1.6	1.6	1.6	1.6	1.6
13. Natural gas in x 169.044 (10^3 scf/d)	–				
14. Fuel oil in Gas Pt (psig)	44	44	44	44	44
15. Fuel P/steam P (psig)					
16. Burner #1	44/58	44/58	44/58	44/58	→
17. Burner #2	38/58	38/58	39/58	38/58	→
18. Burner #3	37/54	37/53	37/54	37/53	→
19. Burner #4	41/54	41/54	40/54	40/54	→
20. Burner #5	39/57	39/57	39/57	38/57	→
21. Burner #6	39/45	39/45	39/45	39/45	→

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UNIT OPERATING DATA - CONTINUED

Test No. 7/14 Date 7-8-80 Location 7 Engr. HART

Unit No. 11HB Fuel Resid Oil Capacity 16250 bbl/d

Unit Type Burner Type

Test Description: 7H-1

22. °2 air flow total P		2.2 1.25/2075	2.2 1.35/2073	2.2 1.25/2077	
23. P to Burner #1		.81/	.81/	.81/	
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)		4	3	2	
30. °2 air damper, % open		5.5/9	5.5/9	5.5/9	
31. °2 air T (°F) #1 N		401	322	247	
32. °2 air T (°F) #2 S		341	262	187	
33. °2 air T (°F) #3 Skin		708	294(?)	420	
34. Stack T (°F)	714	722	726	727	716
35. Fuel Oil T (°F)	185	185	185		
36. Stack Damper (% open)	60	58	58	58	64
37. Bottom Furnace P (iwg)	-.59	-.30	-.09	-.45	-.53
38. Convective P (iwg)	-.29	-.07	+.07	-.21	-.35
39. Stack P (iwg)	-.09	+.11	+.34	-.03	-.10
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	27.2	27.2	27.2	27.2	27.2
42. Flame Observations	all burners on well	#5 burner smoky →	ditto	short #5 smoky	
43. Other Observations	very sparky			much brighter flame	

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UNIT OPERATING DATA

Test No.______

Test No. 7/14 Date 7-8-80 Location 7 Engr. HART

Unit No.______ Fuel______ Capacity______

Unit Type______ Burner Type______

1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr. P (psig)	3.6	3.6	3.6	3.6	3.6
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	6.5	6.9	7.1	7.0	7.0
13. Oil Valve Inlet P (psig)	102	101	102	101	101
14. Oil Valve Outlet P (psig)	47	47	47	47	47
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/14 Date 7-8-80 Location 7 Engr. HART

Unit No. 11H13 Fuel Oil & Gas Capacity 16250 bbl/d

Unit Type Crude process heater Burner Type Zink DBA-22

Test Description: Baseline O_2

1. Test Number	7/14-5				
2. Date	7-8				
3. Time	1435				
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2				
6. Crude T_{in} (°F)	341				
7. Crude T_{out} (°F) East	646				
8. Crude T_{out} (°F) West	643				
9. Crude P_{in} (psig) East	153				
10. Crude P_{in} (psig) West	151				
11. Crude P_{out} (psig)	38				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.6				
13. Natural gas in x 169.044 (10^3 scf/d)	–				
14. Fuel oil in Set Pt. psig	40				
15. Fuel P/steam P (psig)					
16. Burner #1	40/58				
17. Burner #2	34/59				
18. Burner #3	33/56				
19. Burner #4	37/54				
20. Burner #5	26/57				
21. Burner #6	35/45				

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UNIT OPERATING DATA - CONTINUED

Test No. 7/14 Date ______ Location ______ Engr. ______

Unit No. ______ Fuel ______ Capacity ______

Unit Type ______ Burner Type ______

Test Description: baseline

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
.. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	737				
35. Fuel Oil T (°F)	185				
36. Stack Damper (% open)	64				
37. Bottom Furnace P (iwg)	-.59				
38. Convective P (iwg)	-.21				
39. Stack P (iwg)	-.09				
40. Air Registers (% open)	50				
41. Crude API Gravity	27.2				
42. Flame Observations	bright, clear short				
43. Other Observations	changed oil/steam see note pad				

Firebox looks excellent.

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UNIT OPERATING DATA

Test No.

Test No. 7/14 **Date** **Location** **Engr.**

Unit No. **Fuel** **Capacity**

Unit Type **Burner Type**

1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr. P (psig)	7.2				
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	56				
13. Oil Valve Inlet P (psig)	100				
14. Oil Valve Outlet P (psig)	39				
15. Oil Valve ΔP (psi)					
16. Steam Header P	60				
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

.t No. 7/15 Date 7-9-80 Location 7 Engr. HART, T. DANA

Unit No. NM13 Fuel Oil/[illegible] Capacity 16250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: Baseline data | with [illegible] | with [illegible] |

1. Test Number	7/15-1	7/15-2	7/15-3	7/15-4	7/15-5
2. Date	7-9	7-9	7-9	7-9	7-9
3. Time	820	925	1030	1120	1145
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	378	380	381	382	382
7. Crude T_{out} (°F) East	646	644	646	647	645
8. Crude T_{out} (°F) West	647	646	644	647	644
9. Crude P_{in} (psig) East	153	153	153	153	153
10. Crude P_{in} (psig) West	150	150	150	150	150
11. Crude P_{out} (psig)	37.5	38	37.8	38.	38.
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.6	2.5	2.6	2.5	2.5
13. Natural gas in x 169.044 (10^3 scf/d)	–				
14. Fuel oil in set Pt psig	40	40	40	40	40
15. Fuel P/steam P (psig)					
16. Burner #1	40/58	40/58	41/58	40/58	40/58
17. Burner #2	34/59	34/59	34/59	34/59	34/59
18. Burner #3	33/56	32/55	33/56	32/56	33/56
19. Burner #4	37/54	36/54	36/54	36/54	36/54
20. Burner #5	24/57	25/56	25/56	25/57	25/57
21. Burner #6	35/45	35/45	35/45	35/45	35/45

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/15 Date 7-9-80 Location 7 Engr. ____

Unit No. ____ Fuel ____ Capacity ____

Unit Type ____ Burner Type ____

Test Description: ____

22. °2 air flow total P			2.2 .12 / 2068	3.2 .13 / 2070	
23. P to Burner #1			.55/	.75/	
24. P to Burner #2			"	"	
25. P to Burner #3			"	"	
26. P to Burner #4			"	"	
27. P to Burner #5			"	"	
28. P to Burner #6			"	"	
29. Staging height (ft)			4	3	
30. °2 air damper, % open			5.5	5.5	
31. °2 air T (°F) #1 N			387	302	
32. °2 air T (°F) #2 S			327	242	
33. °2 air T (°F) #3 Skin			502	489	
34. Stack T (°F)	743	741	736	733	727
35. Fuel Oil T (°F)	184	184	185	184	—
36. Stack Damper (% open)	60	55	51	51	51
37. Bottom Furnace P (iwg)	-.47	Valve turned up to .3 with crude	-.20	-.19	-.19
38. Convective P (iwg)	-.26		+.07	+.08	+.07
39. Stack P (iwg)	-.02		>+.2	>+.2	>+.2
40. Air Registers (% open)	50	*90*	*90*	*90*	*90*
41. Crude API Gravity	27.2	27.2	27.2	27.2	27.2
42. Flame Observations	bright, clear, short	much brighter and thicker	more bushy		
43. Other Observations	soot burned off tubes which were black yesterday		#1 atomizing poorly		

Page 3

UNIT OPERATING DATA

Test No.

Test No. 7/15 Date 7-9-90 Location 7 Engr.

Unit No. Fuel Capacity

Unit Type Burner Type

1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. Fuel Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr. P (psig)	7.0	7.0	7.0	7.0	7.0
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open	5.9	5.9	5.9	6.1	5.9
13. Oil Valve Inlet P (psig)	102	102	102	102	102
14. Oil Valve Outlet P (psig)	39	39	39	39	39
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-.

UNIT OPERATING DATA

st No. 7/15 Date 7-9-80, 7/11/80 Location 7 Engr. HART, TIDONA

Unit No. 11H13 Fuel Oil + Gas Capacity 16250 bbl/d

Unit Type crude process heater Burner Type Zink DBA-22

Test Description: no staging [illegible] | BASELINE → | 4' Staging 6' Staging

1. Test Number	7/15-2b	7/15-6	7/15-6	7/15-7	7/15-8
2. Date	7-9	7-11	7-11	7-11	7-11
3. Time	1220	08:10	11:15	12:15	13:25
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	382	382	382	383	386
7. Crude T_{out} (°F) East	644	644	644	642	646
8. Crude T_{out} (°F) West	649	648	650	652	645
9. Crude P_{in} (psig) East	153	150	153	153	153
10. Crude P_{in} (psig) West	150	150	150	150	150
11. Crude P_{out} (psig)	38.	37.0	37.5	37.7	37.7
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.6	2.60	2.50	2.50	2.50
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–	–	
14. Fuel oil in 3rd fl Psig	40	40	40	40	40
15. Fuel P/steam P (psig)					
16. Burner #1	40	40/58	→		
17. Burner #2	↓	34/58	→		
18. Burner #3		33/55	→		
19. Burner #4		36/54	→		
20. Burner #5		24/56	→		
21. Burner #6		35/45	→		

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

22. °2 air flow total P' iwg psig/flow				~~2.2~~ 2090	2100
23. P to Burner #1 (psig				X	
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)				4	6
30. °2 air damper, % open				5.5/9	5.5/9
31. °2 air T (°F) #1 N				—	—
32. °2 air T (°F) #2 S				—	—
33. °2 air T (°F) #3 Skin				—	—
34. Stack T (°F)	742	739	737	733	720
35. Fuel Oil T (°F)	—	197	197	197	197
36. Stack Damper (% open)	55	53	56	52	52
37. Bottom Furnace P (iwg)	-.29	-0.29	-0.12	-0.06	-0.15
38. Convective P (iwg)	+.02	+0.05	+0.06	+0.09	+0.[illegible]
39. Stack P (iwg)	7+.15	+0.12	+0.10	+0.20	+0.20
40. Air Registers (% open)	*90*	90	90	90	90
41. Crude API Gravity	27.2	26.5	26.6	26.6	26.6
42. Flame Observations	—	—			long, narrow
43. Other Observations					good, no smoke

Page 3

UNIT OPERATING DATA

Test No.________

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

1. Test Number		7/15-6	7/15-6		
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr. P (psig)	7.0	6.5	6.6	7.0	
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	6.1	5.7	5.8	5.6	5.3
13. Oil Valve Inlet P (psig)	102	100	100	100	100
14. Oil Valve Outlet P (psig)	39	40	40	41	40
15. Oil Valve ΔP (psi)	63	60	60	59	60
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

ast No. 7/15 Date 7-11-80 Location 7 Engr. T. DONA

Unit No. 11H13 Fuel Absorber Gas plus No.6 Oil Capacity 16,250 bbl/d

Unit Type Burner Type

Test Description:

1. Test Number	7/15-9	7/15-6			
2. Date	7-11-80	7-11-80			
3. Time	14:25	15:20			
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2			
6. Crude T_{in} (°F)	384	386			
7. Crude T_{out} (°F) East	643	642			
8. Crude T_{out} (°F) West	649	652			
9. Crude P_{in} (psig) East	153	155			
10. Crude P_{in} (psig) West	150	152			
11. Crude P_{out} (psig)	38.0	37.5			
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.40	2.50			
13. Natural gas in x 169.044 (10^3 scf/d)	—	—			
14. Fuel oil in	40 psig	40			
15. Fuel P/steam P (psig)					
16. Burner #1	40/60	40/60			
17. Burner #2	↓	↓			
18. Burner #3					
19. Burner #4					
20. Burner #5					
21. Burner #6					

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.____________ Date______________ Location______________ Engr.______________

Unit No.____________ Fuel______________ Capacity______________

Unit Type______________________ Burner Type______________________

Test Description:______________________

	7/15-9	7/15-6			
22. °2 air flow total P	-! 2100	-0.			
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)	8	–			
30. °2 air damper, % open	55h	–			
. °2 air T (°F) #1	–	–			
32. °2 air T (°F) #2	–	–			
33. °2 air T (°F) #3	–	–			
34. Stack T (°F)	657	743			
35. Fuel Oil T (°F)	197	197			
36. Stack Damper (% open)	51	55			
37. Bottom Furnace P (iwg)	-0.14	O.O.S.			
38. Convective P (iwg)	+0.03	"			
39. Stack P (iwg)	+0.21	"			
40. Air Registers (% open)	90	90			
41. Crude API Gravity	26.6	26.6			
42. Flame Observations	long, narrow				
43. Other Observations	Stack T ↓				

Page 3

UNIT OPERATING DATA **Test No.**______

Test No.______ **Date**______ **Location**______ **Engr.**______

Unit No.______ **Fuel**______ **Capacity**______

Unit Type______ **Burner Type**______

1. Test Number	7/15-9	7/15-6			
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)	6.5	7.0			
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open	5.4	5.3			
13. Oil Valve Inlet P (psig)	100	100			
14. Oil Valve Outlet P (psig)	40	40			
15. Oil Valve ΔP (psi)	60	60			
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Shee

UNIT OPERATING DATA

st No. 7/16 Date 7-15-80 Location 7 Engr. HART, TIDONA

Unit No. NH 13 Fuel Oil + NG/FG Capacity 16250 bbl/[illegible]

Unit Type Crude process heater Burner Type Zink DBA-22

Test Description: Baseline low stg. med. stg. high stg.

1. Test Number	7/16-1	7/16-2	7/16-3	7/16-4	7/16-26
2. Date	7-15	7-15	7-15	7-15	7-15
3. Time	940	1035	1125	1150	1215
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	380	380	381	380	381
7. Crude T_{out} (°F) East	647	652	656	655	651
8. Crude T_{out} (°F) West	642	642	636	637	644
9. Crude P_{in} (psig) East	159	155	155	159	159
10. Crude P_{in} (psig) West	159	159	159	159	159
11. Crude P_{out} (psig)	38.5	39.5	38.5	39.5	38.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)					
13. Natural gas in x 169.044 (10^3 scf/d)	3.25	3.25	3.2	3.3	3.2
14. Fuel oil in Set Pt.	40	40	40	40	40
15. Fuel P/steam P (psig)					
16. Burner #1	37/58	37/58	36/58	36/58	36/58
17. Burner #2	24/58	24/58	24/59	24/59	24/59
18. Burner #3	32/56	32/56	32/56	32/56	32/56
19. Burner #4	36/56	36/56	36/56	36/56	36/56
20. Burner #5	21/56	21/56	21/56	21/56	21/56
21. Burner #6	35/44	35/44	35/44	35/44	35/44

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/16 Date ___ Location ___ Engr. ___

Unit No. ___ Fuel ___ Capacity ___

Unit Type ___ Burner Type ___

Test Description:

	7/16-1	7/16-2	7/16-3	7/16-4	7/16-2B
22. °2 air flow total P		1668	2092	2366	1680
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)		4	4	4	4
30. °2 air damper, % open					
°2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	751	749	743	742	750
35. Fuel Oil T (°F)	195	-	-		
36. Stack Damper (% open)	61	59	58	58	60.5
37. Bottom Furnace P (iwg)	0	0	0	0	0
38. Convective P (iwg)	-.10	0	0	0	+.05
39. Stack P (iwg)	-.04	0	0	0	+.12
40. Air Registers (% open)	50	50	50	50	50
41. Crude API Gravity	27.8	27.8	27.8	27.8	27.8
42. Flame Observations		long, less bright			
43. Other Observations		#1 slightly sooty		#6 burner almost out	

Page 3

UNIT OPERATING DATA

Test No.

Test No. 7/16 Date Location Engr.

Unit No. Fuel Capacity

Unit Type Burner Type

1. Test Number	7/16-1	7/16-2	7/16-3	7/16-4	7/16-2b
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr P (psig)	8.0	8.0	8.0	8.0	8.0
9. Fuel Gas Brn Man P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open	5.5	5.5	5.4	5.4	5.4
13. Oil Valve Inlet P (psig)	100	100	102	102	102
14. Oil Valve Outlet P (psig)	40	40	39	40	40
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/16 Date 7-15-90 Location 7 Engr. HARJ, T.Rosia

Unit No. 11H13 Fuel Oil + Nat Gas & Reabs. Capacity 16250 bbl/d

Unit Type process heater Burner Type DBA-22

Test Description: baseline [illegible] 1200 low stg 1650 mod stg

1. Test Number	7/16-3b	7/16-1b	7/16-5	7/16-6	7/16-7
2. Date	7-15	7-15	7-15	7-15	7-15
3. Time		1300	1620	1657	1715
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d		6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)		382	384	384	383
7. Crude T_{out} (°F) East		645	647	646	650
8. Crude T_{out} (°F) West		635	638	636	633
9. Crude P_{in} (psig) East			157	157	157
10. Crude P_{in} (psig) West			159	159	159
11. Crude P_{out} (psig)			39.	39.	39
12. Reabsorber gas in x 205.856 (10^3 scf/d)		—	2.0	2.0	2.0
13. Natural gas in x 169.044 (10^3 scf/d)		3.1	—	—	—
14. Fuel oil in Set Pt.		40	90	40	40
15. Fuel P/steam P (psig)					—
16. Burner #1		/	38/58	38/58	38/58
17. Burner #2		/	34/58	34/58	34/58
18. Burner #3		/	32/56	32/56	32/56
19. Burner #4		/	36/56	36/56	36/56
20. Burner #5		/	20/56	20/56	20/56
21. Burner #6		/	35/45	35/45	35/45

UNIT OPERATING DATA - CONTINUED

Test No.____________ Date________________ Location______________ Engr.________________

Unit No.____________ Fuel________________ Capacity________________________________

Unit Type_________________________________ Burner Type_____________________________

Test Description:____

22. *2 air flow total P				/1200	/1200
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)				4	4
30. *2 air damper, % open					
.. *2 air T (°F) #1					
32. *2 air T (°F) #2					
33. *2 air T (°F) #3					
34. Stack T (°F)	7	744	712	712	710
35. Fuel Oil T (°F)					
36. Stack Damper (% open)			51	50	50
37. Bottom Furnace P (iwg)			0	0	
38. Convective P (iwg)			+.04	+.09	0
39. Stack P (iwg)			+.10	+.16	
40. Air Registers (% open)		50	50	50	50
41. Crude API Gravity		27.8	27.8	27.8	27.8
42. Flame Observations			dull & smoky		
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No.________

Test No.________ **Date**________ **Location**________ **Engr.**________

Unit No.________ **Fuel**________ **Capacity**________

Unit Type________ **Burner Type**________

1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr. P (psig)		8.0	5.0	5.0	5.0
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open		5.4	5.5	5.5	5.5
13. Oil Valve Inlet P (psig)		102	100	100	100
14. Oil Valve Outlet P (psig)		40	40	40	40
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/16 Date 7-15-80 Location 7 Engr. HART

Unit No. 11H13 Fuel Oil + Reab. Gas Capacity 16250 bbl/d

Unit Type crude heater Burner Type Zink DBA-22

Test Description: - 2/100 [illegible] Stg. % [illegible]

1. Test Number	7/16-8	7/16-10			
2. Date	7-15	7-15			
3. Time	1740	1800			
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2			
6. Crude T_{in} (°F)	384	383			
7. Crude T_{out} (°F) East	650	637			
8. Crude T_{out} (°F) West	634	649			
9. Crude P_{in} (psig) East					
0. Crude P_{in} (psig) West					
11. Crude P_{out} (psig)					
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.0	2.0			
13. Natural gas in x 169.044 (10^3 scf/d)	—				
14. Fuel oil in 52 + PT	40				
15. Fuel P/steam P (psig)					
16. Burner #1	SAME /	SAME			
17. Burner #2	/				
18. Burner #3	/				
19. Burner #4	/				
20. Burner #5	/				
21. Burner #6	/				

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/16 Date______ Location______ Engr.______

Unit No.______ Fuel______ Capacity______

Unit Type______ Burner Type______

Test Description:______

	7/16-9	7/16-10			
22. °2 air flow total P	20.76				
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
31. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	707	737			
35. Fuel Oil T (°F)					
36. Stack Damper (% open)					
37. Bottom Furnace P (iwg)					
38. Convective P (iwg)					
39. Stack P (iwg)					
40. Air Registers (% open)	50				
41. Crude API Gravity	27.8				
42. Flame Observations					
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No.______

Test No. 7/16______ Date__________ Location______________ Engr.__________

Unit No.______________ Fuel__________ Capacity______________________________

Unit Type______________________________ Burner Type______________________________

1. Test Number	7/16-8	7/16-10			
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)					
9. Fuel Gas Brn Man. P (psig)	SAME				
10. Fuel Gas Control Valve % open	↓	↓			
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)					
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

UNIT OPERATING DATA

Test No. 7/17 Date 7-10-90 Location 7 Engr. HART, Tidona

Unit No. 11H13 Fuel Oil+Gas Capacity 16250 bbl/d

Unit Type crude heater Burner Type Zink DBA-22

Test Description: Particulates

1. Test Number	7/17-1P	7/17-1P			
2. Date	7-10	7-10			
3. Time	1600	1920			
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2			
6. Crude T_{in} (°F)	385	385			
7. Crude T_{out} (°F) East	643	642			
8. Crude T_{out} (°F) West	652	652			
9. Crude P_{in} (psig) East	153				
10. Crude P_{in} (psig) West	150				
11. Crude P_{out} (psig)	38				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.55	2.45			
13. Natural gas in x 169.044 (10^3 scf/d)					
14. Fuel oil in 3t Pt	40	40			
15. Fuel P/steam P (psig)					
16. Burner #1	40/58				
17. Burner #2	34/58				
18. Burner #3	32/56				
19. Burner #4	36/54				
20. Burner #5	24/56				
21. Burner #6	35/45				

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/17 Date ____ Location ____ Engr. ____

Unit No. ____ Fuel ____ Capacity ____

Unit Type ____ Burner Type ____

Test Description: ____

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
31. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	733	733			
35. Fuel Oil T (°F)	195				
36. Stack Damper (% open)	55				
37. Bottom Furnace P (iwg)	-.26				
38. Convective P (iwg)	+.04				
39. Stack P (iwg)	+.15				
40. Air Registers (% open)	#90#	90			
41. Crude API Gravity	26.5	26.5			
42. Flame Observations	#1 burner edges smoky				
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No.________

Test No. 7/17 **Date**________ **Location**________ **Engr.**________

Unit No.________ **Fuel**________ **Capacity**________

Unit Type________ **Burner Type**________

1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr. P (psig)	7.0				
9. Fuel Gas Brn. Mani P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open	5.9	6.0			
13. Oil Valve Inlet P (psig)	102	100			
14. Oil Valve Outlet P (psig)	89	90			
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/17-2P Date 7-16-80 Location 7 Engr. Hart, Tidona

Unit No. 11 H13 Fuel No 6 Oil + Adsorber Gas Capacity 16,250 bbl/d

Unit Type CRUDE HTR. Burner Type ZINK DBA-22

Test Description: BASELINE | PARTICULATES

1. Test Number	7/17-2P	7/17-2P			
2. Date	7-16-80	7-16			
3. Time	15:55	2025			
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2			
6. Crude T_{in} (°F)	386	395			
7. Crude T_{out} (°F) East	640	643			
8. Crude T_{out} (°F) West	646	651			
9. Crude P_{in} (psig) East	159				
10. Crude P_{in} (psig) West	150				
11. Crude P_{out} (psig)	38.5				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	1.65	2.0			
13. Natural gas in x 169.044 (10^3 scf/d)	—				
14. Fuel oil in ([illegible])	60	40			
15. Fuel P/steam P (psig)					
16. Burner #1	52/86				
17. Burner #2	55/87				
18. Burner #3	54/83				
19. Burner #4	57/71				
20. Burner #5	35/84				
21. Burner #6	55/74				

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.____________ Date________________ Location______________ Engr.________________

Unit No.____________ Fuel________________ Capacity______________________________

Unit Type____________________________ Burner Type____________________________

Test Description:____

	7/15-2P				
22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
31. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	749	745			
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	58				
37. Bottom Furnace P (iwg)	0.0.5.				
38. Convective P (iwg)	+0.07				
39. Stack P (iwg)	+0.12				
40. Air Registers (% open)	90	90			
41. Crude API Gravity	27.8	27.8			
42. Flame Observations	good				
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No.________

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

1. Test Number	7/17-2P				
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)	4.0				
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	6.2 psi	5.1			
13. Oil Valve Inlet P (psig)	100	100			
14. Oil Valve Outlet P (psig)	62	42			
15. Oil Valve ΔP (psi)	38				
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/17-3P Date 7-17-80 Location 7 Engr. TIDONA, MART

Unit No. 11 H13 Fuel #6 Oil + Reab. Gas Capacity 16250 bbl /d

Unit Type crude heater Burner Type Zink, DBA-22

Test Description: BASELINE PARTICULATES ANDERSEN #2 → | ANDERSEN #3

1. Test Number	7/17-3P	7/17-3P	7/17-3P		
2. Date	7-17-80	7-17-80	7-17-80		
3. Time	10:00	12:25	16:35		
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2		
6. Crude T_{in} (°F)	383	388	378		
7. Crude T_{out} (°F) East	638	638	628		
8. Crude T_{out} (°F) West	650	651	638		
9. Crude P_{in} (psig) East	160	160	160		
10. Crude P_{in} (psig) West	150	162	165		
11. Crude P_{out} (psig)	38.4	39.3	38.7		
12. Reabsorber gas in x 205.856 (10^3 scf/d)	2.2	2.2	2.2		
13. Natural gas in x 169.044 (10^3 scf/d)	0	0	0		
14. Fuel oil in Set. Pt.	60 psi	62	62		
15. Fuel P/steam P (psig)					
16. Burner #1	52/85	53/86	54/91		
17. Burner #2	54/85	56/86	55/92		
18. Burner #3	53/82	55/83	55/88		
19. Burner #4	58/73	59/73	Plugged		
20. Burner #5	36/84	37/85	37/90		
21. Burner #6	56/72	57/73	58/78		

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/17-3P Date Location Engr.

Unit No. Fuel Capacity

Unit Type Burner Type

Test Description:

22. °2 air flow total P					
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
31. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	746	743	755		
35. Fuel Oil T (°F)	195	195	197		
36. Stack Damper (% open)	53	53	55		
37. Bottom Furnace P (iwg)	0.0.5	→	→		
38. Convective P (iwg)	0.0.5.	→	→		
39. Stack P (iwg)	0.0.5	→	→		
40. Secondary Air Registers (% open)	90	90	90		
41. Crude API Gravity	27.9	27.8	27.8		
42. Flame Observations	good		oK		
43. Other Observations	Gas flow ↑	→	burner #4 oil tip plugged		

Page 3

UNIT OPERATING DATA

Test No.________

Test No. 7/17-3P **Date**________ **Location**________ **Engr.**________

Unit No.________ **Fuel**________ **Capacity**________

Unit Type________ **Burner Type**________

1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)					
9. Fuel Gas Brn. Man. P (psig)	5.6	6.0	5.0		
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open	6.2psi	6.2			
13. Oil Valve Inlet P (psig)	98	104	105		
14. Oil Valve Outlet P (psig)	61.5	62.5	62		
15. Oil Valve ΔP (psi)	36.5	41.5	43		
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

.st No. 7/18 Date 7-16-80 Location 7 Engr. HART, TIDONA

Unit No. 11H13 Fuel [illegible] oil Capacity 16250 bbl/d

Unit Type crude heater Burner Type Zink COA-22

Test Description: baseline [illegible] [illegible] stg. low stg. med. stg

1. Test Number	7/18-1	7/18-2	7/18-3	7/18-4	7/18-5
2. Date	7-16	7-16	7-16	7-16	7-16
3. Time	1005	1115	1215	1315	1345
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	383	384	384	384	385
7. Crude T_{out} (°F) East	643	642	641	640	644
8. Crude T_{out} (°F) West	645	646	648	646	642
9. Crude P_{in} (psig) East	160	159	159	159	159
10. Crude P_{in} (psig) West	158	152	152	152	152
11. Crude P_{out} (psig)	38.5	38.5	38.5	38.5	38.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	1.65	1.60	1.65	1.65	1.65
13. Natural gas in x 169.044 (10^3 scf/d)	—				
14. Fuel oil in Set Point	60	60	60	60	60
15. Fuel P/steam P (psig)					
16. Burner #1	57/86	57/86	57/86	52/86	52/86
17. Burner #2	55/87	55/87	56/87	55/87	55/87
18. Burner #3	54/83	54/83	54/83	54/83	54/83
19. Burner #4	57/71	57/71	57/71	57/71	57/71
20. Burner #5	35/84	35/84	35/84	35/84	35/84
21. Burner #6	55/74	55/74	55/74	55/74	55/74

UNIT OPERATING DATA - CONTINUED

st No. 7/16 Date______ Location______ Engr.______

Unit No.______ Fuel______ Capacity______

Unit Type______ Burner Type______

Test Description:______

	7/18-1	7/19-2	7/19-3	7/19-4	7/19-5
22. °2 air flow total P			1200	1200	1665
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)			4	4	4
30. °2 air damper, % open					
1. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	754	715	717	718	715
35. Fuel Oil T (°F)	196				
36. Stack Damper (% open)	60	50	50	49	48
37. Bottom Furnace P (iwg)	0	0	0	0	0
38. Convective P (iwg)	-.08	+.04	+.12	+.12	+.23
39. Stack P (iwg)	-.01	+.10	>+.20	>+.20	+.31
40. Air Registers (% open)	50	50	* 90 *	* 90 *	* 90 *
41. Crude API Gravity	27.8	27.8	27.8	27.8	27.8
42. Flame Observations	long, bright		very smoky	good fire	
3. Other Observations			* primary air ½ open	prim air 100% open	

Page 3

UNIT OPERATING DATA

Test No.______

Test No. 7/18 Date__________ Location______________ Engr.__________

Unit No.__________ Fuel__________ Capacity__________________________

Unit Type____________________________ Burner Type____________________

1. Test Number	7/18-1	7/18-2	7/18-3	7/18-4	7/18-5
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr. P (psig)	4.0	3.5	4	4	4
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	6.8	6.3	6.8	6.6	6.2
13. Oil Valve Inlet P (psig)	98	98	98	98	100
14. Oil Valve Outlet P (psig)	62	62	62	62	62
15. Oil Valve ΔP (psi)					
16. Steam Header P	86		86	86	86
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/19 Date 7-16-80 Location 7 Engr. HART, TIDONA

Unit No. 11H13 Fuel Abs. bot Oil Capacity 16250 bbl/d

Unit Type crude heater Burner Type Zink DBA-22

Test Description: high cty.

1. Test Number	7/18-6	7/19-7	7/18-8		
2. Date	7-16	7-16	7-16		
3. Time	1405	1500	1555		
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2		
6. Crude T_{in} (°F)	385	385	386		
7. Crude T_{out} (°F) East	649	639	640		
8. Crude T_{out} (°F) West	636	645	646		
9. Crude P_{in} (psig) East	159	159	159		
10. Crude P_{in} (psig) West	150	150	150		
11. Crude P_{out} (psig)	38.5	38.5	38.5		
12. Reabsorber gas in x 205.856 (10^3 scf/d)	1.65	1.65	1.65		
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–		
14. Fuel oil in Set Pt.	60	60	60		
15. Fuel P/steam P (psig)					
16. Burner #1	52/86	52/86	52/86		
17. Burner #2	55/87	55/87	55/87		
18. Burner #3	54/83	54/83	54/83		
19. Burner #4	57/71	57/71	57/71		
20. Burner #5	35/84	35/84	35/84		
21. Burner #6	55/74	55/74	55/74		

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

	7/18-6	7/18-7	7/18-8		
22. °2 air flow total P	2100				
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)					
30. °2 air damper, % open					
. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	708	715	749		
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	48	49	58		
37. Bottom Furnace P (iwg)	0	0	0		
38. Convective P (iwg)	+.25	+.15	-.07		
39. Stack P (iwg)	+.33	+.23	-.12		
40. Air Registers (% open)	0 90 0	0 90 0	0 90 0		
41. Crude API Gravity	27.8	27.8	27.8		
42. Flame Observations	dull,	–			
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No.

Test No. 7/18 Date Location Engr.

Unit No. Fuel Capacity

Unit Type Burner Type

1. Test Number	7/18-6	7/18-7	7/18-8		
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)	4.0	4.0	4.0		
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open	6.2	6.3	6.2		
13. Oil Valve Inlet P (psig)	100	98	100		
14. Oil Valve Outlet P (psig)	63	62	62		
15. Oil Valve ΔP (psi)					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/19-1P Date 7-18-80 Location 7 Engr. HART, TIDEZIA

Unit No. 11H13 Fuel Oil + Reab Gas Capacity 16250 [illegible]

Unit Type crude heater Burner Type Zink DBA-22

Test Description: Baseline Baseline

1. Test Number	7/19-1	7/19-1P	7/19-1P	7/19-1	
2. Date	7-18	7-18	7-18	7-18	
3. Time	945	1115	1600	1635	
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	
6. Crude T_{in} (°F)	380	382	384	384	
7. Crude T_{out} (°F) East	634	650	649	640	
8. Crude T_{out} (°F) West	637	638	638	647	
9. Crude P_{in} (psig) East	150				
10. Crude P_{in} (psig) West	150				
11. Crude P_{out} (psig)	37.5				
12. Reabsorber gas in x 205.856 (10^3 scf/d)	1.3	1.6	1.6	1.6	
13. Natural gas in x 169.044 (10^3 scf/d)					
14. Fuel oil in Set Pt.	62	60	60	60	
15. Fuel P/steam P (psig)					
16. Burner #1	/				
17. Burner #2	/				
18. Burner #3	/				
19. Burner #4	/				
20. Burner #5	/				
21. Burner #6	/				

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:________

	7/9-1P				
22. °2 air flow total P		2100	2100		
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)		4	4		
30. °2 air damper, % open					
.. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	737	710	715	746	
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	55	49	49	55	
37. Bottom Furnace P (iwg)					
38. Convective P (iwg)					
39. Stack P (iwg)					
40. Air Registers (% open)	90	90	90	98	
41. Crude API Gravity	27.8	27.8	27.9	27.9	
42. Flame Observations	dark yellow				
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No.______

Test No. 7/19-1P **Date**______ **Location**______ **Engr.**______

Unit No.______ **Fuel**______ **Capacity**______

Unit Type______ **Burner Type**______

1. Test Number	7/19-1P				
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr. P (psig)	2.5	3.5			
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	6.4	6.1			
13. Oil Valve Inlet P (psig)	104	104			
14. Oil Valve Outlet P (psig)	62.5	62			
15. Oil Valve ΔP (psi)					
16. Steam Hdr.	86	85			
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No. 7/19-2&3P Date 7-21-80 Location 7 Engr. HART

Unit No. 11H13 Fuel #6 Oil + Reab. Gas Capacity 16250 BBL/d

Unit Type crude heater Burner Type E&L DBA-22

Test Description:	baseline	low NOx	low NOx	low NOx	baseline
1. Test Number	7/19-2	7/19-2P.	7/19-3P	7/19-3P	7/19-3
2. Date	7-21	7-21	7-21	7-21	7-21
3. Time	925	1105	1415	1745	1825
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.2	6.2	6.2	6.2	6.2
6. Crude T_{in} (°F)	384	387	388	388	388
7. Crude T_{out} (°F) East	639	640	641	639	640
8. Crude T_{out} (°F) West	647	644	644	645	647
9. Crude P_{in} (psig) East	150	150	150	150	150
10. Crude P_{in} (psig) West	150	150	150	150	150
11. Crude P_{out} (psig)	38.5	38.5	38.5	38.5	38.5
12. Reabsorber gas in x 205.856 (10^3 scf/d)	1.65	1.6	1.6	1.6	1.65
13. Natural gas in x 169.044 (10^3 scf/d)	—	—			
14. Fuel oil in Set Pt	60	60	60	60	60
15. Fuel P/steam P (psig)					
16. Burner #1	51/84				
17. Burner #2	55/85				
18. Burner #3	54/82				
19. Burner #4	60/80				
20. Burner #5	35/83				
21. Burner #6	50/70				

Page 2

UNIT OPERATING DATA - CONTINUED

Test No. 7/19 2/3-P Date 7-21-80 Location 7 Engr.

Unit No. 11 HB Fuel NG + Capacity

Unit Type Burner Type

Test Description:

	7/19-2	7/19-2P	7/19-3P	7/19-3P	7/19-2
22. °2 air flow total P		2088	2113	2113	
23. P to Burner #1					
24. P to Burner #2					
25. P to Burner #3					
26. P to Burner #4					
27. P to Burner #5					
28. P to Burner #6					
29. Staging height (ft)		4	4	4	
30. °2 air damper, % open					
. °2 air T (°F) #1					
32. °2 air T (°F) #2					
33. °2 air T (°F) #3					
34. Stack T (°F)	747	704	714	716	752
35. Fuel Oil T (°F)					
36. Stack Damper (% open)	53	45	50	50	58
37. Bottom Furnace P (iwg)					
38. Convective P (iwg)					
39. Stack P (iwg)					
40. Air Registers (% open)	90	90	90	90	90
41. Crude API Gravity	27.2	27.2	27.2	27.2	27.2
42. Flame Observations	gd-clear	smoky at edges			
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No._______

Test No. 7/19 2p:3p **Date** 7-21-80 **Location** 7 **Engr.**_______

Unit No. H H 13 **Fuel** MGn + **Capacity**_______

Unit Type_______ **Burner Type**_______

1. Test Number	7/19-2P	7/19-2P	7/19-3P	7/19-3P	7/19-3P
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr. P (psig)	3.8	3.8	3.5		
9. Fuel Gas Brn. Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve, % open	6.7	6.7	6.4	6.2	6.3
13. Oil Valve Inlet P (psig)	104	104	104	104	103
14. Oil Valve Outlet P (psig)	61.5	61.5	62	64	62
15. Oil Valve ΔP (psi)					
16. Steam Hdr.	85	85	85		
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

SITE 7 - FUEL ANALYSES

Sample Identification:

1. Location 7, Test 7/15-1 to 7/15-5 & 7/14 & 7/15-6 to 9, 7/9/80 No. 6 oil fuel
2. Location 7, Test 7/17-2P + 7/18 7/16/80 No. 6 oil fuel & 7/16
3. Location 7, Test 7/19-2P, 7/19-3P 7/21/80 No. 6 oil fuel

Ultimate Analysis:	1	2	3
Carbon, %	85.90	86.40	87.24
Hydrogen, %	10.63	10.50	10.80
Nitrogen, %	0.90	0.86	0.88
Sulfur, %	0.95	0.92	0.98
Ash, %	0.008	0.011	0.011
Oxygen, % (by difference)	1.61	1.31	0.09
API Gravity @ 60°F	11.7	11.7	11.7
Heat of Combustion:			
Gross BTU/lb	18,420	18,390	18,400
Net BTU/lb	17,450	17,430	17,400

JUNE 30 PLANT ANALYSIS OF NO. 6 OIL FUEL

CARBON, %	87.14
HYDROGEN%	10.76
ASH, %	NONE
NITROGEN, %	0.76
SULFUR, %	0.77
CHLORINE, %	0.04
OXYGEN, % BY DIFF.	0.53
HHV (Btu/lb)	20,357
API Gravity at 60°F	11.0

GAS ANALYSIS REPORT For all tests involving natural gas (Tests 7/1 - 7/3)

LABORATORY: GAS LAB

OPERATOR: Joseph Selgrath

DATE: June 13, 1980

UNIT NAT GAS	South Cal NAT GAS	upstream of [illegible]				
SAMPLE DATE	6/13/80					
SAMPLE TIME	8 ^{30}AM					
PERCENT	GAS Vol					
HYDROGEN 13						
NITROGEN + INERTS 9						
OXYGEN	0.1					
CARBON MONOXIDE 17	1.0					
CARBON DIOXIDE 21	0.9					
HYDROGEN SULFIDE 25						
METHANE 29	88.5					
ETHANE 33	7.6					
ETHYLENE 37						
PROPANE 41	1.7					
PROPYLENE 45						
ISOBUTANE 49	0.1					
NORMAL BUTANE 53	0.1					
TOTAL BUTENES 57						
1, 3–BUTADIENE 61						
ISOPENTANE 65	TRACE					
NORMAL PENTANE 69	TRACE					
TOTAL PENTENES 73						
TOTAL C_6 PLUS 77						

DIST.: LOW (2)

REMARKS:

PREPARED BY: Joseph Selgrath

SUBMITTED BY:

81.889 (4-80)

GAS ANALYSIS REPORT Test 9, 7/4

LABORATORY: GAS LAB		**OPERATOR:** D. SPRAGUE			**DATE:** JUNE 17, 1980	
UNIT: FUEL GAS	NO. 1 FUEL GAS DRUM					
SAMPLE DATE	6-17-80					
SAMPLE TIME	$8^{\underline{15}}$ AM					
PERCENT	GAS VOL.					
HYDROGEN 13	20.2					
NITROGEN + INERTS 9						
OXYGEN						
CARBON MONOXIDE 17	0.6					
CARBON DIOXIDE 21	1.1					
HYDROGEN SULFIDE 25	0.5					
METHANE 29	48.0					
ETHANE 33	12.1					
ETHYLENE 37	4.0					
PROPANE 41	7.1					
PROPYLENE 45	2.6					
ISOBUTANE 49	1.4					
NORMAL BUTANE 53	0.9					
TOTAL BUTENES 57	0.7					
1, 3–BUTADIENE 61						
ISOPENTANE 65	0.3					
NORMAL PENTANE 69	0.1					
TOTAL PENTENES 73	0.3					
TOTAL C_6 PLUS 77	0.1					

DIST.: GDD LDW(2)	**REMARKS:**	**PREPARED BY:** D Sprague **SUBMITTED BY:** A. G. Wyman

83.869 (6-80)

GAS ANALYSIS REPORT Tests 7/5

LABORATORY: GAS LAB

OPERATOR: D. SPRAGUE

DATE: JUNE 18, 1980

UNIT: FUEL GAS	NOT FUEL GAS DRUM	into				
SAMPLE DATE	6-18-80	heater				
SAMPLE TIME	2^{45} PM	actual (?)				
PERCENT	GAS VOL.					
HYDROGEN 13	21.3					
NITROGEN + INERTS 9						
OXYGEN						
CARBON MONOXIDE 17	0.6					
CARBON DIOXIDE 21	1.0					
HYDROGEN SULFIDE 25	0.1					
METHANE 29	42.1					
ETHANE 33	12.0					
ETHYLENE 37	4.2					
PROPANE 41	9.0					
PROPYLENE 45	3.8					
ISOBUTANE 49	1.7					
NORMAL BUTANE 53	1.7					
TOTAL BUTENES 57	1.0					
1, 3–BUTADIENE 61						
ISOPENTANE 65	0.7					
NORMAL PENTANE 69	0.3					
TOTAL PENTENES 73	0.3					
TOTAL C_6 PLUS 77	0.2					

DIST.: GDD
LDW(2)

REMARKS:

PREPARED BY: D Sprague

SUBMITTED BY: A. G. Wigman

81.889 (4-68)

GAS ANALYSIS REPORT

LABORATORY: Gas Lab
OPERATOR: Joseph Selgvath
DATE: June 25, 1980

UNIT: FUEL GAS		GAS TO 11 N 13					
SAMPLE DATE		6/25/80					
SAMPLE TIME		9:00 AM					
PERCENT		GAS Vol.					
HYDROGEN	13	13.6					
NITROGEN + INERTS	9						
OXYGEN							
CARBON MONOXIDE	17	0.7					
CARBON DIOXIDE	21						
HYDROGEN SULFIDE	25						
METHANE	29	31.4					
ETHANE	33	17.9					
ETHYLENE	37	5.5					
PROPANE	41	22.7					
PROPYLENE	45	3.5					
ISOBUTANE	49	3.5					
NORMAL BUTANE	53	0.3					
TOTAL BUTENES	57	$\boxed{39}$ 0.4					
1, 3–BUTADIENE	61						
ISOPENTANE	65	0.2					
NORMAL PENTANE	69	0.1					
TOTAL PENTENES	73	0.2					
TOTAL C_6 PLUS	77						

DIST.: GDO (3)
LDW (3)

REMARKS:

PREPARED BY: Joseph Selgvath

SUBMITTED BY: James D. McMahon

81.200 (4-80)

Wt %
H 19.98
C 79.6
O 0.43

GAS ANALYSIS REPORT

LABORATORY: GAS LAB

OPERATOR: Joseph Selgrath

DATE: June 26, 1980

UNIT: ADSORBER ~~Fuel~~, GAS		GAS TO 11H13					
SAMPLE DATE		6/26/80					
SAMPLE TIME		8^{30}/AM					
PERCENT		GAS Vol.					
HYDROGEN	13	13.6					
NITROGEN + INERTS	9						
OXYGEN							
CARBON MONOXIDE	17	0.8					
CARBON DIOXIDE	21						
HYDROGEN SULFIDE	25						
METHANE	29	32.5					
ETHANE	33	17.6					
ETHYLENE	37	5.8					
PROPANE	41	21.4					
PROPYLENE	45	3.5					
ISOBUTANE	49	3.0					
NORMAL BUTANE	53	0.4					
TOTAL BUTENES	57	0.5					
1, 3–BUTADIENE	61						
ISOPENTANE	65	0.2					
NORMAL PENTANE	69	0.1					
TOTAL PENTENES	73	0.4					
TOTAL C_6 PLUS	77	0.2					

DIST.: GDD(2)
LDW(2)

REMARKS:

PREPARED BY: Joseph Selgrath

SUBMITTED BY: James D. McMahon

83.889 (4-80)

Wt % H 19.94
C 79.59
O 0.47

GAS ANALYSIS REPORT

LABORATORY: GAS LAB
OPERATOR: Joseph Selgrath
DATE: June 27, 1980

UNIT: ABSORBER GAS		GAS TO 11H13					
SAMPLE DATE		6/27/80					
SAMPLE TIME		8^{30}/AM					
PERCENT		Gas Vol.					
HYDROGEN	13	14.3					
NITROGEN + INERTS	9						
OXYGEN							
CARBON MONOXIDE	17	0.8					
CARBON DIOXIDE	21						
HYDROGEN SULFIDE	25						
METHANE	29	32.7					
ETHANE	33	17.3					
ETHYLENE	37	5.8					
PROPANE	41	21.3					
PROPYLENE	45	3.7					
ISOBUTANE	49	2.4					
NORMAL BUTANE	53	0.4					
TOTAL BUTENES	57	0.6					
1, 3–BUTADIENE	61						
ISOPENTANE	65	0.3					
NORMAL PENTANE	69	0.1					
TOTAL PENTENES	73	0.3					
TOTAL C_6 PLUS	77						

DIST.: GDD(2)
COW(2)

REMARKS:

PREPARED BY: Joseph Selgrath

SUBMITTED BY: James D McMahon (75)

GAS ANALYSIS REPORT

LABORATORY: GAS LAB		OPERATOR: Joseph Selgrath			DATE: July 15, 1980	
UNIT: ADSORBER GAS	GAS TO 11H13					
SAMPLE DATE	7/15/80					
SAMPLE TIME	8^{00} AM					
PERCENT	Gas Vol.					
HYDROGEN 13	10.9					
NITROGEN + INERTS 9						
OXYGEN						
CARBON MONOXIDE 17	0.7					
CARBON DIOXIDE 21						
HYDROGEN SULFIDE 25						
METHANE 29	27.1					
ETHANE 33	15.7					
ETHYLENE 37	4.4					
PROPANE 41	33.4					
PROPYLENE 45	2.5					
ISOBUTANE 49	3.8					
NORMAL BUTANE 53	0.4					
TOTAL BUTENES 57	0.4					
1, 3–BUTADIENE 61						
ISOPENTANE 65	0.2					
NORMAL PENTANE 69	0.1					
TOTAL PENTENES 73	0.3					
TOTAL C_6 PLUS 77	0.1					

DIST.: LDW (2) GDO (2)	REMARKS:	PREPARED BY: Joseph Selgrath SUBMITTED BY: A. G. Wyman

for 7/15-5 – 7/18 except 7/17-1P, and for 7/19-1,1P

GAS ANALYSIS REPORT

LABORATORY: GAS LAB
OPERATOR: Joseph Selgrath
DATE: July 18, 1980

UNIT: Fuel Gas		ADSORBER GAS TO 11H13				
SAMPLE DATE		7/17/80				
SAMPLE TIME		9:30 AM				
PERCENT		Gas Vol.				
HYDROGEN	13	16.9				
NITROGEN + INERTS	9					
OXYGEN						
CARBON MONOXIDE	17	1.4				
CARBON DIOXIDE	21					
HYDROGEN SULFIDE	25					
METHANE	29	39.1				
ETHANE	33	17.2				
ETHYLENE	37	8.0				
PROPANE	41	10.1				
PROPYLENE	45	5.0				
ISOBUTANE	49	0.3				
NORMAL BUTANE	53	0.3				
TOTAL BUTENES	57	0.8				
1, 3–BUTADIENE	61					
ISOPENTANE	65	0.3				
NORMAL PENTANE	69	0.1				
TOTAL PENTENES	73	0.4				
TOTAL C_6 PLUS	77	0.1				

DIST.: RVG
LOW

REMARKS:

PREPARED BY: Joseph Selgrath

SUBMITTED BY: A. G. [illegible]

GAS ANALYSIS REPORT

LABORATORY: Gas Lab		OPERATOR: Joseph Selgrath			DATE: July 21, 1980	
UNIT: Fuel Gas	Adsorber Gas to 11H13					
SAMPLE DATE	7/21/80					
SAMPLE TIME	9^{30} AM					
PERCENT	Gas Vol.					
HYDROGEN 13	13.0					
NITROGEN & INERTS 9						
OXYGEN						
CARBON MONOXIDE 17	0.4					
CARBON DIOXIDE 21						
HYDROGEN SULFIDE 25						
METHANE 29	30.7					
ETHANE 33	17.0					
ETHYLENE 37	5.8					
PROPANE 41	24.1					
PROPYLENE 45	3.5					
ISOBUTANE 49	4.1					
NORMAL BUTANE 53	0.4					
TOTAL BUTENES 57	0.5					
1, 3–BUTADIENE 61						
ISOPENTANE 65	0.2					
NORMAL PENTANE 69	0.1					
TOTAL PENTENES 73	0.2					
TOTAL C_6 PLUS 77						

DIST.: LDW GDD RUB	REMARKS:	PREPARED BY: Joseph Selgrath SUBMITTED BY: D S

HP-67 KEYED CALCULATION SHEET*

PARTICULATE EMISSION CALCULATIONS

Test No. 7/17-1P Date 7-10-80 Location 7 Engr. Tidona

Unit No. 11H13 Fuel No.6 Oil + ADSORBER GAS Sampling Train and Method JOY; 5

Pitot Factor, Fs .837 Barometric Pressure, P_{bar} 30.0 (STO 0) in. Hg

Tot. Liquid Collected, V_{lc} 83.7 (STO 1) ml Total Particulate, M_n ____ (STO 2) m gm Total = 351.4 Solid = 299.3

Velocity Head, ΔP 0.596 (STO 3) iwg Stack Temp., Ts 624 (STO 4) °F Stack Area, As 13.91 (STO 5) ft^2

Sample Volume, Vm 27.10 (STO 6) ft^3 Stack Press., Psg +0.15(?) (STO 7) iwg Excess O_2, XO_2% 3.7 (STO 8) %

Orifice Press. Diff., H 0.463 (STO 9) iwg Stack Gas Sp. Gravity, Gs 0.95 (STO A) n.d.

Sample Time, θ 72 (STO B) min Nozzle Dia., Dn 0.245 (STO C) in. Meter Temp., T_m 100 (STO D) °F

Select F_e	Oil (A)	Gas (B)	Coal (C)	Other: 70/30 Gas/0.1
SC Feet/10^4 Btu	92.2	87.4	98.2	88.8 (D)

Press (E) if meter is not temperature compensated.

1. Sample Gas Volume	$Vm_{std} = 0.0334\ \overset{27.1}{Vm}(\overset{30.04}{P_{bar}} + H/13.6)$			25.729	SCF
2. Water Vapor	$Vw_{std} = 0.0474\ \overset{83.7}{V_{lc}}$			3.967	SCF
3. Moisture Content	$Bwo = Eq. 2/(Eq. 1 + Eq. 2)$			0.1336	N.D.
			solid	total	
4. Concentration	a. $C = 0.0154\ Mn/Vm_{std}$		0.1791	0.2103	grains/DSCF
	b. $C = 2.205 \times 10^{-6}\ Mn/Vm_{std}$		2.565×10^{-5}	3.012×10^{-5}	lb/DSCF
	c. $C = Eq. 4b \times 16.018 \times 10^3$		0.4109	0.4825	grams/DSCM
5. Abs. Stack Press.	$Ps = P_{bar} \times 13.6 + Psg$			408.15	in. w abs.
6. Stack Gas Speed	$Vs = 174\ Fs \sqrt{\Delta PTs} \sqrt{\frac{407}{Ps} \times \frac{1.00}{Gs}}$			3761	ft/min
7. Stack Gas Flow Rate @ 70°F	a. $Qsw = Eq. 6 \times As \times \frac{530}{Ts} \times \frac{Ps}{407}$			25,646	WSCF/min
	b. $Qsd = Eq. 7a \times (1. - Eq. 3)$			22,220	DSCF/min
			solid	total	
8. Material Flow	$Ms = Eq. 7b \times Eq. 4b \times 60$		34.202	40.155	lb/hr
9. XO_2 factor	$XO_2f = 2090/(20.9 - XO_2\%)$			121.51	N.D.
10. Emission	a. $E = Eq. 4b \times Fe \times Eq. 9$		0.2768	0.3250	lb/MMBtu
	b. $E = Eq. 4c \times Fm \times Eq. 9 \times 1000$		119.0	139.7	ng/joule
11. % Isokinetic	$I = \frac{14077 \times Ts(Vm_{std} + Vw_{std})}{\theta \times Vs \times Ps \times Dn^2}$			68.31	%

*If calculating by hand:
1) Convert T_s and T_m to °R
2) Multiply EQ 1 by $530/T_m$(°R) if meter not temperature compensated.
3) $F_m = 2.684 \times 10^{-5} \times F_e$

Data Sheet 6002-4
Revised 2/15/78

HP-67 KEYED CALCULATION SHEET*

PARTICULATE EMISSION CALCULATIONS

Test No. 7/17-2P Date 7/16/80 Location SITE 7 Engr: Tirone/Hart

Unit No. 11 H 13 Fuel [illegible]/OIL Sampling Train and Method PARTICULATE

Pitot Factor, Fs .837 Barometric Pressure, P_{bar} 30.00 (STO 0) in. Hg

Tot. Liquid Collected, V_{1c} 81 (STO 1) ml Total Particulate, M_n (STO 2) m gm Total: 485.8 Solid: 397.5

Velocity Head, ΔP .3192 (STO 3) iwg Stack Temp., Ts 652 (STO 4) °F Stack Area, As 15.91 (STO 5) ft^2

Sample Volume, Vm 26.41 (STO 6) ft^3 Stack Press., Psg .12 (STO 7) iwg Excess O_2, XO_2% 4.0 (STO 8) %

Orifice Press. Diff., H .3612051 (STO 9) iwg Stack Gas Sp. Gravity, Gs 0.95 (STO A) n.d.

Sample Time, θ 72 (STO B) min Nozzle Dia., Dn 0.245 (STO C) in. Meter Temp., T_m 110 (STC D) °F

107.5/112.5

Select F_e	Oil (A)	Gas (B)	Coal (C)	Other: 50/50 Gas/Oil
SC Feet/10^4 Btu	92.2	87.4	98.2	89.8 (-)

Press (E) if meter is not temperature compensated.

1. Sample Gas Volume $Vm_{std} = 0.0334\ Vm(P_{bar} + H/13.6)$ R/S → 24.628 SCF
2. Water Vapor $Vw_{std} = 0.0474\ V_{1c}$ 3.839 SCF
3. Moisture Content Bwo = Eq. 2/(Eq. 1 + Eq. 2) 0.1349 N.D.
4. Concentration a. $C = 0.0154\ Mn/Vm_{std}$ solid 0.2486 total 0.3038 grains/DSCF
   b. $C = 2.205 \times 10^{-6}\ Mn/Vm_{std}$ 3.559×10^{-5} 4.350×10^{-5} lb/DSCF
   c. $C = Eq.\ 4b \times 16.018 \times 10^3$ 0.5701 0.6968 grams/DSCM
5. Abs. Stack Press. $Ps = P_{bar} \times 13.6 + Psg$ 408.12 in. w abs.
6. Stack Gas Speed $Vs = 174\ Fs\ \sqrt{\Delta P Ts}\sqrt{\frac{407}{Ps} \times \frac{1.00}{Gs}}$ 2788 ft/min
7. Stack Gas Flow Rate @ 70°F a. $Qsw = Eq.\ 6 \times As \times \frac{530}{Ts} \times \frac{Ps}{407}$ 18,530 WSCF/min
   b. Qsd = Eq. 7a x (1. - Eq. 3) 16,031 DSCF/min
8. Material Flow Ms = Eq. 7b x Eq. 4b x 60 34.2366 41.8418 lb/hr
9. XO_2 factor $XO_2f = 2090/(20.9 - XO_2\%)$ 123.669 N.D.
10. Emission a. E = Eq. 4b x Fe x Eq. 9 0.3953 0.4831 lb/MMBtu
    b. E = Eq. 4c x Fm x Eq. 9 x 1000 170.0 207.9 ng/joule
11. % Isokinetic $I = \frac{14077 \times Ts(Vm_{std} + Vw_{std})}{\theta \times Vs \times Ps \times Dn^2}$ 90.62 %

*If calculating by hand:
1) Convert T_s and T_m to °R
2) Multiply EQ 1 by $530/T_m$(°R) if meter not temperature compensated.
3) $F_m = 2.684 \times 10^{-5} \times F_e$

Data Sheet 6002-4
Revised 2/15/78

HP-67 KEYED CALCULATION SHEET*

PARTICULATE EMISSION CALCULATIONS

Test No. 7/17-3P Date 7/17/80 Location Site 7 Engr. Tirado/Hunt

Unit No. 11 H 13 Fuel Person Gas/Oil Sampling Train and Method ________

Pitot Factor, Fs .837 Barometric Pressure, P_{bar} 30.00 (STO 0) in. Hg

Tot. Liquid Collected, V_{1c} 114.5 (STO 1) ml Total Particulate, M_n ____ (STO 2) m gm Total = 92.5 Solid = 56.0

Velocity Head, ΔP .400 (STO 3) iwg Stack Temp., Ts 650 (STO 4) °F Stack Area, As 13.91 (STO 5) ft^2

Sample Volume, Vm 31.46 (STO 6) ft^3 Stack Press., Psg -.7 (STO 7) iwg Excess O_2, XO_2% 4.0 (STO 8) %

Orifice Press. Diff., H .4735 (STO 9) iwg Stack Gas Sp. Gravity, Gs .95 (STO A) n.d.

Sample Time, θ 72 (STO B) min Nozzle Dia., Dn .245 (STO C) in. Meter Temp., T_m 105 (STO D) °F

Select F_e	Oil (A)	Gas (B)	Coal (C)	Other: 63/37 % gas/oil
SC Feet/10^4 Btu	92.2	87.4	98.2	89.2 (-)

Press (E) if meter is not temperature compensated.

			Solid	total	
1. Sample Gas Volume		$Vm_{std} = 0.0334\ Vm(P_{bar} + H/13.6)$		29.6045	SCF
2. Water Vapor		$Vw_{std} = 0.0474\ V_{1c}$		5.4273	SCF
3. Moisture Content		Bwo = Eq. 2/(Eq. 1 + Eq. 2)		0.1549	N.D.
4. Concentration	a.	$C = 0.0154\ Mn/Vm_{std}$	0.0291	0.0481	grains/DSCF
	b.	$C = 2.205 \times 10^{-6}\ Mn/Vm_{std}$	4.172×10^{-6}	6.890×10^{-6}	lb/DSCF
	c.	$C = \text{Eq. 4b} \times 16.018 \times 10^3$	0.0668	0.1104	grams/DSCM
5. Abs. Stack Press.		$Ps = P_{bar} \times 13.6 + Psg$		407.300	in. w abs.
6. Stack Gas Speed		$Vs = 174\ Fs \sqrt{\Delta P Ts} \sqrt{\frac{407}{Ps} \times \frac{1.00}{Gs}}$		3121.1	ft/min
7. Stack Gas Flow Rate @ 70°F	a.	$Qsw = \text{Eq. 6} \times As \times \frac{530}{Ts} \times \frac{Ps}{407}$		20741	WSCF/min
	b.	Qsd = Eq. 7a x (1. - Eq. 3)		17528	DSCF/min
8. Material Flow		Ms = Eq. 7b x Eq. 4b x 60	4.3871	7.2465	lb/hr
9. XO_2 factor		$XO_2f = 2090/(20.9 - XO_2\%)$		123.6686	N.D.
10. Emission	a.	E = Eq. 4b x Fe x Eq. 9	0.0460	0.0760	lb/MMBtu
	b.	E = Eq. 4c x Fm x Eq. 9 x 1000	19.787	32.684	ng/joule
11. % Isokinetic		$I = \frac{14077 \times Ts(Vm_{std} + Vw_{std})}{\theta \times Vs \times Ps \times Dn^2}$		99.636	%

*If calculating by hand:
1) Convert T_s and T_m to °R
2) Multiply EQ 1 by $530/T_m$(°R) if meter not temperature compensated.
3) $F_m = 2.684 \times 10^{-5} \times F_e$

Data Sheet 6002-4
Revised 2/15/78

HP-67 KEYED CALCULATION SHEET*

PARTICULATE EMISSION CALCULATIONS

Test No. 7/19-1B Date 7/18/80 [illegible] Location SITE 7 Engr. HART/TIDONA

Unit No. 11 H13 Fuel GAS/OIL Sampling Train and Method Joy, Method 5

Pitot Factor, Fs .837 Barometric Pressure, P_{bar} 29.8 (STO 0) in. Hg

Tot. Liquid Collected, V_{1c} 112.6 (STO 1) ml Total Particulate, M_n ______ (STO 2) m gm tot : 156.8 sol. = 112.7

Velocity Head, ΔP 0.510 (STO 3) iwg Stack Temp., Ts 640 (STO 4) °F Stack Area, As 13.91 (STO 5) ft^2

Sample Volume, Vm 40.05 (STO 6) ft^3 Stack Press., Psg -0 (STO 7) iwg Excess O_2, XO_2% 2.3 (STO 8) %

Orifice Press. Diff., ΔH 0.607 (STO 9) iwg Stack Gas Sp. Gravity, Gs 0.95 (STO A) n.d.

Sample Time, θ 72 (STO B) min Nozzle Dia., Dn 0.245 (STO C) in. Meter Temp., T_m 108 (STO D) °F

Select F_e	Oil (A)	Gas (B)	Coal (C)	Other: 55/45 gas/oil
SC Feet/10^4 Btu	92.2	87.4	98.2	89.6 (D)

Press (E) if meter is not temperature compensated.

1. Sample Gas Volume $Vm_{std} = 0.0334\ Vm(P_{bar} + H/13.6)$ 37.2514 SCF
2. Water Vapor $Vw_{std} = 0.0474\ V_{1c}$ 5.3372 SCF
3. Moisture Content Bwo = Eq. 2/(Eq. 1 + Eq. 2) 0.1253 N.D.
4. Concentration (solid / total)
   - a. $C = 0.0154\ Mn/Vm_{std}$ 0.0466 0.0648 grains/DSCF
   - b. $C = 2.205 \times 10^{-6}\ Mn/Vm_{std}$ 6.672×10^{-6} 9.283×10^{-6} lb/DSCF
   - c. $C = \text{Eq. 4b} \times 16.018 \times 10^3$ 0.1069 0.1487 grams/DSCM
5. Abs. Stack Press. $Ps = P_{bar} \times 13.6 + Psg$ 405.280 in. w abs.
6. Stack Gas Speed $Vs = 174\ Fs\ \sqrt{\Delta P Ts}\sqrt{\frac{407}{Ps} \times \frac{1.00}{Gs}}$ 3517.0 ft/min
7. Stack Gas Flow Rate @ 70°F
   - a. $Qsw = \text{Eq. 6} \times As \times \frac{530}{Ts} \times \frac{Ps}{407}$ 23468 WSCF/min
   - b. Qsd = Eq. 7a x (1. - Eq. 3) 20527 DSCF/min
8. Material Flow Ms = Eq. 7b x Eq. 4b x 60 8.2171 11.4325 lb/hr
9. XO_2 factor $XO_2f = 2090/(20.9 - XO_2\%)$ 112.3656 N.D.
10. Emission
    - a. E = Eq. 4b x Fe x Eq. 9 0.0672 0.0935 lb/MMBtu
    - b. E = Eq. 4c x Fm x Eq. 9 x 1000 28.884 40.186 ng/joule
11. % Isokinetic $I = \frac{14077 \times Ts(Vm_{std} + Vw_{std})}{\theta \times Vs \times Ps \times Dn^2}$ 107.05 %

*If calculating by hand:
1) Convert T_s and T_m to °R
2) Multiply EQ 1 by $530/T_m$(°R) if meter not temperature compensated.
3) $F_m = 2.684 \times 10^{-5} \times F_e$

Data Sheet 6002-4
Revised 2/15/78

HP-67 KEYED CALCULATION SHEET*

PARTICULATE EMISSION CALCULATIONS

Test No. 7/19-2P Date 7/21/80 Location 7 Engr. Hart

Unit No. 11H13 Fuel Gas + No.6 oil Sampling Train and Method Joy, Method 5

Pitot Factor, Fs .837 Barometric Pressure, P_{bar} 29.9 (STO 0) in. Hg

Tot. Liquid Collected, V_{1c} 116.0 (STO 1) ml Total Particulate, M_n (STO 2) = gm total = 67.4 solids 36.4

Velocity Head, ΔP 0.875 (STO 3) iwg Stack Temp., Ts 633 (STO 4) °F Stack Area, As 13.91 (STO 5) ft^2

Sample Volume, Vm 30.99 (STO 6) ft^3 Stack Press., Psg 0 (STO 7) iwg Excess O_2, XO_2% 2 (STO 8) %

Orifice Press. Diff., H 1.005 (STO 9) iwg, (Flue Gas Density/Air Density) @ T_s, Gs 0.95 (STO A) n.d.

Sample Time, θ 72 (STO B) min Nozzle Dia., Dn 0.245 (STO C) in. Meter Temp., T_m 93 (STO D) °F

Select F_e	Oil (A)	Gas (B)	Coal (C)	Other: 55/45 gas/oil
SC Feet/10^4 Btu	92.2	87.4	98.2	89.6 (-)

Press (E) if meter is not temperature compensated.

			solid	total	
1. Sample Gas Volume		$Vm_{std} = 0.0334\ Vm(P_{bar} + H/13.6)$		29.7346	SCF
2. Water Vapor		$Vw_{std} = 0.0474\ V_{1c}$		5.4984	SCF
3. Moisture Content		Bwo = Eq. 2/(Eq. 1 + Eq. 2)		0.1561	N.D.
4. Concentration	a.	$C = 0.0154\ Mn/Vm_{std}$	0.0189	0.0349	grains/DSCF
	b.	$C = 2.205 \times 10^{-6}\ Mn/Vm_{std}$	2.700×10^{-6}	5.000×10^{-6}	lb/DSCF
	c.	$C = \text{Eq. 4b} \times 16.018 \times 10^3$	0.0432	0.0801	grams/DSCM
5. Abs. Stack Press.		$Ps = P_{bar} \times 13.6 + Psg$		406.640	in. w abs.
6. Stack Gas Speed		$Vs = 174\ Fs \sqrt{\Delta P Ts} \sqrt{\frac{407}{Ps} \times \frac{1.00}{Gs}}$		4584	ft/min
7. Stack Gas Flow Rate @ 70°F	a.	$Qsw = \text{Eq. 6} \times As \times \frac{530}{Ts} \times \frac{Ps}{407}$		30889	WSCF/min
	b.	Qsd = Eq. 7a x (1. - Eq. 3)		26069	DSCF/min
8. Material Flow		Ms = Eq. 7b x Eq. 4b x 60	4.2225	7.8186	lb/hr
9. XO_2 factor		$XO_2f = 2090/(20.9 - XO_2\%)$		110.5820	N.D.
10. Emission	a.	E = Eq. 4b x Fe x Eq. 9	0.0267	0.0495	lb/MMBtu
	b.	E = Eq. 4c x Fm x Eq. 9 x 1000	11.502	21.2972	ng/joule
11. % Isokinetic		$I = \frac{14077 \times Ts(Vm_{std} + Vw_{std})}{\theta \times Vs \times Ps \times Dn^2}$		67.29	%

*If calculating by hand:
1) Convert T_s and T_m to °R
2) Multiply EQ 1 by $530/T_m$(°R) if meter not temperature compensated.
3) $F_m = 2.684 \times 10^{-5} \times F_e$

Data Sheet 6002-4
Revised 9/27/78

HF-67 KEYED CALCULATION SHEET*

PARTICULATE EMISSION CALCULATIONS

Test No. 7/19-3P Date 7/21/80 Location 7 Engr. Hart

Unit No. 11 H13 Fuel Gas - No.6 Oil Sampling Train and Method Joy, Method 5

Pitot Factor, Fs .837 Barometric Pressure, P_{bar} 29.9 (STO 0) in. Hg

Tot. Liquid Collected, V_{lc} 58.4 (STO 1) ml Total Particulate, M_n ____ (STO 2) m gm total = 22.9 solid = 10.5

Velocity Head, ΔP 0.675 (STO 3) iwg Stack Temp., Ts 625 (STO 4) °F Stack Area, As 13.91 (STO 5) ft^2

Sample Volume, Vm 31.81 (STO 6) ft^3 Stack Press., Psg 0 (STO 7) iwg Excess O_2, XO_2% 2.3 (STO 8) %

Orifice Press. Diff., H 0,790 (STO 9) iwg, (Flue Gas Density/Air Density) @ T_s, Gs 0.95 (STO A) n.d.

Sample Time, θ 72 (STO B) min Nozzle Dia., Dn 0,245 (STO C) in. Meter Temp., T_m 104 (STO D) °F

Select F_e	Oil (A)	Gas (B)	Coal (C)	Other: 55/45 gas/oil
SC Feet/10^4 Btu	92.2	87.4	98.2	89.6 (–)

Press (E) if meter is not temperature compensated.

		Solid	total	
1. Sample Gas Volume	$Vm_{std} = 0.0334\ Vm(P_{bar} + H/13.6)$		29.9103	SCF
2. Water Vapor	$Vw_{std} = 0.0474\ V_{lc}$		2.7682	SCF
3. Moisture Content	Bwo = Eq. 2/(Eq. 1 + Eq. 2)		0.0847	N.D.
4. Concentration	a. $C = 0.0154\ Mn/Vm_{std}$	0.0054	0.0118	grains/DSCF
	b. $C = 2.205 \times 10^{-6}\ Mn/Vm_{std}$	7.742×10^{-7}	1.648×10^{-6}	lb/DSCF
	c. $C = \text{Eq. 4b} \times 16.018 \times 10^3$	0.0124	0.0270	grams/DSCM
5. Abs. Stack Press.	$Ps = P_{bar} \times 13.6 + Psg$		406.640	in. w abs.
6. Stack Gas Speed	$Vs = 174\ Fs \sqrt{\Delta P Ts} \sqrt{\frac{407}{Ps} \times \frac{1.00}{Gs}}$		4012	ft/min
7. Stack Gas Flow Rate @ 70°F	a. $Qsw = \text{Eq. 6} \times As \times \frac{530}{Ts} \times \frac{Ps}{407}$		27230	WSCF/min
	b. Qsd = Eq. 7a x (1. - Eq. 3)		24923	DSCF/min
8. Material Flow	Ms = Eq. 7b x Eq. 4b x 60	1.1577	2.5249	lb/hr
9. XO_2 factor	$XO_2f = 2090/(20.9 - XO_2\%)$		112.3656	N.D.
10. Emission	a. E = Eq. 4b x Fe x Eq. 9	0.0078	0.0170	lb/MMBtu
	b. E = Eq. 4c x Fm x Eq. 9 x 1000	3.352	7.310	ng/joule
11. % Isokinetic	$I = \frac{14077 \times Ts(Vm_{std} + Vw_{std})}{\theta \times Vs \times Ps \times Dn^2}$		70.794	%

If calculating by hand:
1) Convert T_s and T_m to °R
2) Multiply EQ 1 by $530/T_m$(°R) if meter not temperature compensated.
3) $F_m = 2.684 \times 10^{-5} \times F_e$

Data Sheet 6002-4
Revised 9/27/78

PARTICULATE CALCULATION SHEET

Test No. 7/17-1P (Inlet, Outlet)
Box No.
Test Description: PARTICULATE BASELINE
Location 7
Test Date 7/10/80

Dry Gas Meter Vol (ft3)
Final 1752.32
Initial 1725.22
Total 27.10

Impinger Water Vol (ml)

	1	2	3	Total	SR GEL
Final	170	106	1	277	493.6
Initial	100	100	0	200	486.9
Δ Vol				77	6.7

Total vol = 27.1 ft³ std Total H₂O = 6.7+77 = 837 ml = 83.7 g

							Filter No.	Blank No.
Beaker No.		1 IMP	1P Ac	1P H₂O	H₂O BLANK		101 A	102 A
Date Weighed		7-24-80	7-24-80	7-24-80	7-24-80	7-24-80	5-21-80	5-21-80
Tare Wt.	1	109.3176	95.8837	99.6987	95.5587	95.7231	0.8512	0.7771
	2	109.3176	95.8838	99.6986	95.5588	95.7232	0.8513	0.7772
	3	109.3177	95.8838	99.6986	95.5588	95.7233	0.8512	0.7774
	4							
	5							
	6							
	Avg	109.3176	95.8838	99.6986	95.5588	95.7232	0.8512	0.7772
Bottle No.					H₂O BLANK	ACETONE BLK		
Content		Impinger (Water)	Probe (Acetone)	Probe (Water)	~~Cyclone~~ (~~Acetone~~)	~~Blank~~ ~~(Dry)~~		
Rinse (ml)		316	248	308	98	100		
Date Weighed or 250 Bake)		8-18-80	8-18-80	8-19-80	8-13-80	8-19-80	7-29-80	7-29-80
Final Wt. 250	1	109.3644	95.9476	99.7128	95.5573	95.7244	1.0691	0.7766
	2	109.3645	95.9474	99.7125	95.5570	95.7242	1.0691	0.7766
	3	109.3647	95.9473	99.7123	95.5573	95.7232	1.0692	0.7767
	4					95.7231		
	5					95.7227		
	6							
	Avg	109.3645	95.9474	99.7125	95.5572	95.7230	1.0691	0.7766
Residue Wt Final 250 Tare)		0.0469 0.0521 cor	0.0636 0.0619 cor	0.0139 0.0189 cor	−0.0016 = −1.63 × 10⁻⁵ g/ml	0.0007 = 7×10⁻⁶ g/ml	0.2179 + 0.0006 0.2185 cor	−0.0006
Date Weighed or 650 Bake)								
Final Wt. 650	1							
	2							
	3							
	4							
	5							
	6							
	Avg							
Residue Wt. Final 650 Tare)								

Comments: Solid Partic. ≡ Probe Acetone + Probe Water + Filter Residue
Tot. Partic. ≡ Solid Partic. + Impinger H₂O Residue

8830-5

PARTICULATE CALCULATION SHEET

Test No. 7/17-2P (Inlet, Outlet)
Box No.
st Description: PARTICULATE

Location 7
Test Date 7/16/80

Dry Gas Meter Vol (ft3)
Final 1776.97
Initial 1750.46
Total 26.41

FILTER #
103A

Impinger Water Vol (ml)

	1	2	3	Total	SILICA GEL
Final	168	104	2	274	498.6
Initial	100	100	0	200	491.6 gm
Δ Vol	68	4	2	74	7

							Filter No.	Blank No.
Beaker No.		2 IMP	2P AC	2P H2O			103	
Date Weighed		7-24-80	7-24-80	7-24-80			5-21-80	
Tare Wt.	1	107.9755	92.7461	95.3321			0.7683	
	2	107.9755	92.7461	95.3321			0.7686	
	3	107.9756	92.7460	95.3322			0.7686	
	4							
	5							
	6							
	Avg	107.9755	92.7461	95.3321			0.7685	
Bottle No.								
Content		Impinger (Water)	Probe (Acetone)	Probe (Water)	Cyclone (Acetone)	Flask (Dry)		
inse (ml)		492	441	334				
ate Weighed or 250 Bake)		8-18-80	8-18-80	8-19-80			7-29-80	
Final Wt. 250	1	108.0561	92.8272	95.3387			1.0757	
	2	108.0564	92.8269	95.3383			1.0759	
	3	108.0556	92.8267	95.3386			1.0759	
	4	108.0559						
	5	108.0558						
	6							
	Avg	108.0558	92.8269	95.3386			1.0758	
Residue Wt. Final 250 Tare)		0.0803 0.0883 cor	0.0808 0.0777 ~~0.0839~~ cor	0.0065 0.0119 cor			0.3073 +0.0006 0.3079 cor	
Date Weighed or 650 Bake)								
Final Wt. 650	1							
	2							
	3							
	4							
	5							
	6							
	Avg							
Residue Wt. Final 650 Tare)								

mments:

8830-5

PARTICULATE CALCULATION SHEET

Test No. 7/17-3P Date 7/17/80 Location Site 7 Test Crew [illegible]/FROHOFF
Box No. ______ Sample Probe Position ______
Test Description

Dry Gas Meter Vol. (ft^3)
Final 1808.45
Initial 1776.99
Total 31.46

Impinger Water Vol (ml)

	1	2	3	S. Gel	Total
Final	136	118	2	455.6	751.6
Initial	100	100	0	447.1	647.1
Δ Vol	36	18	2	8.5	104.5

							Filter No.	Blank No.
Beaker No.		3 IMP	3P AC	3P H_2O			104	
Date Weighed		7-24-80	7-24-80	7-24-80			5-21-80	
Tare Wt.	1	93.2230	103.7409	94.0643			0.7635	
	2	93.2231	103.7410	94.0644			0.7637	
	3	93.2230	103.7410	94.0644			0.7636	
	4							
	5							
	6							
	Avg	93.2230	103.7410	94.0644			0.7636	
Bottle No.								
Content		Impinger (Water)	Probe (Acetone)	Probe (Water)	Cyclone (Acetone)	Flask (Dry)		
Rinse (ml)		538	130	100				
Date Weighed or 250 Bake		8-18-80	8-18-80	8-13-80			7-29-80	
Final Wt. 250	1	93.2508	103.7456	94.0634			0.8154	
	2	93.2504	103.7451	94.0635			0.8149	
	3	93.2509	103.7451	94.0630			0.8154	
	4			94.0632				
	5			94.0633				
	6							
	Avg	93.2507	103.7453	94.0632			0.8152	
Residue wt Final 250-Tare		0.0277 0.0365 cor	0.0043 0.0038 [illegible] cor	-0.0012 0.0004 cor			0.0516 +0.0006 0.0522 cor	
Date Weighed or 650 Bake								
Final Wt. 650	1							
	2							
	3							
	4							
	5							
	6							
	Avg							
Residue Wt Final 650-Tare								

Comments:

Data Sheet 6002-3

PARTICULATE CALCULATION SHEET

Test No. 7/19-1PAR (Inlet, Outlet)
Box No. ____
Test Description: PARTICULATE

Location SITE 7
Test Date 7/18/80

Dry Gas Meter Vol (ft3)
Final 1848.55
Initial 1808.50
Total 40.05

Impinger Water Vol (ml)

	1	2	3	Total	SILICA GEL
Final	184	112	2	298	214.6
Initial	100	100	0	200	200 gR
Δ Vol	84	12	2	98	14.6

							Filter No.	Blank No.
Beaker No.		4 IMP	4P AC	4P H_2O			105	
Date Weighed		7-24-80	7-24-80	7-24-80			5-21-80	
Tare Wt.	1	104.9638	103.6710	104.7506			0.7781	
	2	104.9637	103.6711	104.7507			0.7779	
	3	104.9638	103.6710	104.7508			0.7779	
	4							
	5							
	6							
	Avg	104.9638	103.6710	104.7507			0.7780	
Bottle No.								
Content		Impinger (Water)	Probe (Acetone)	Probe (Water)	Cyclone (Acetone)	Flask (Dry)		
Rinse (ml)		519	324.	240				
Date Weighed or 250 Bake)		8-18-80	8-18-80	8-13-80			7-29-80	
Final Wt. 250	1	104.9996	103.6875	104.7551			0.8676	
	2	104.9991	103.6873	104.7552			0.8679	
	3	104.9996	103.6871	104.7550			0.8679	
	4		103.6874					
	5							
	6							
	Avg	104.9994	103.6873	104.7551			0.8678	
Residue Wt Final 250 Tare)		0.0356 0.0441 cor	0.0163 0.0140 cor	0.0044 0.0083 cor			0.0898 -0.0006 0.0904 cor	
Date Weighed or 650 Bake)								
Final Wt. 650	1							
	2							
	3							
	4							
	5							
	6							
	Avg							
Residue Wt. Final 650 Tare)								

Comments:

8830-5

PARTICULATE CALCULATION SHEET

Test No. 7/19-2P (Inlet, Outlet)
Location SITE 7
Box No. ______
Test Date 7/19-2P
Test Description: ______

Dry Gas Meter Vol (ft3)
Final 1879.62
Initial 1848.63
Total 30.99

FILTER # 106

Impinger Water Vol (ml)

	1	2	3	Total	SILICA GE
Final	190	114	4	301	441.0
Initial	100	100	0	200	433.0
△ Vol	96	14	4	108	8.0

							Filter No.	Blank No.
Beaker No.		5 IMP	SP AC	SP H₂O			106	
Date Weighed		7-24-80	7-24-80	7-24-80			5-21-80	
Tare Wt.	1	108.0960	103.4777	100.5913			0.7839	
	2	108.0959	103.4772	100.5914			0.7838	
	3	108.0960	103.4772	100.5914			0.7838	
	4							
	5							
	6							
	Avg	108.0960	103.4774	100.5914			0.7838	
Bottle No.								
Content		Impinger (Water)	Probe (Acetone)	Probe (Water)	Cyclone (Acetone)	Flask (Dry)		
Rinse (ml)		388	269	225				
Date Weighed or 250 Bake)		8-19-80	8-13-80	8-13-80			7-29-80	
Final Wt. 250	1	108.1210	103.4874	100.5971			0.8032	
	2	108.1205	103.4870	100.5969			0.8032	
	3	108.1205	103.4868	100.5966			0.8032	
	4		103.4864					
	5		103.4863					
	6							
	Avg	108.1207	103.4865	100.5969			0.8032	
Residue Wt Final 250 Tare)		0.0247 0.0310 cor	0.0091 0.0072 cor	0.0055 0.0092 cor			0.0194 0.0006 0.0200 cor	
Date Weighed or 650 Bake)								
Final Wt. 650	1							
	2							
	3							
	4							
	5							
	6							
	Avg							
Residue Wt. Final 650 Tare)								

Comments:

8830-5

PARTICULATE CALCULATION SHEET

Test No. 7/19-3P (Inlet, Outlet)
Box No.
Test Description: PARTICULATE

Location SITE 7
Test Date 7/21/80

Dry Gas Meter Vol (ft3)
Final 1911.43
Initial 1879.62
Total 31.81

FILTER #
107

Impinger Water Vol (ml)

	1	2	3	Total	SILICA GEL
Final	140	108	2	250	476.8
Initial	100	100	0	200	468.4
Δ Vol	40	8	2	50	8.4

Beaker No.		6 IMP	6P AC	6P H2O	H2O Blank B		Filter No. 107	Blank No.
Date Weighed		7-24-80	7-24-80	7-24-80	7-24-80		5-21-80	
Tare Wt.	1	90.0143	92.7247	99.8839	98.5334		0.7765	
	2	90.0144	92.7248	99.8839	98.5335		0.7767	
	3	90.0144	92.7247	99.8840	98.5334		0.7766	
	4							
	5							
	6							
	Avg	90.0144	92.7247	99.8839	98.5334		0.7766	
Bottle No.		299	142	140	259			
Content		Impinger (Water)	Probe (Acetone)	Probe (Water)	Cyclone (Acetone)	Flask (Dry)		
Rinse (ml)								
e Weighed or 250 Bake)		8-19-80	8-13-80	8-13-80	8-19-80		7-29-80	
Final Wt. 250	1	90.0265	92.7269	99.8821	98.5338		0.7855	
	2	90.0274	92.7268	99.8829	98.5338		0.7850	
	3	90.0272	92.7271	99.8826	98.5337		0.7854	
	4	90.0274		99.8824				
	5							
	6							
	Avg	90.0273	92.7269	99.8826	98.5338		0.7853	
Residue Wt Final 250 Tare)		0.0129 0.0124 cor	0.0022 0.0012 cor	-0.0013 0 cor	0.0004 $=1.54 \times 10^{-6}$ g/ml		0.0087 +0.0006 0.0093	
Date Weighed or 650 Bake)								
Final Wt. 650	1							
	2							
	3							
	4							
	5							
	6							
	Avg							
Residue Wt. Final 650 Tare)								

Comments:

8830-5

KVB

Test No. 7/17-1P
Engr. ______

STACK DATA

Date 7/10/80 Location SITE 7 Unit No. ______ Fuel ______
Load HIGH K#/hr or MBtu/hr ______ Filter No. 101 (102 BLANK)
Sample Box No. ______ Meter Box No. W3 Probe No. ______ Probe Length 6'E
Stack Moisture 12.7 %
Ambient Temperature 95 °F
Nozzle Diameter 0.245 in.
Atmospheric Pressure 30.0 in.Hg
Stack Gas Pressure, Ps ___ iwg
Stack Area, As ______ ft^2

Remarks:
Final Meter: 1725.22
Initial Meter: 1752.32
v = 27.10 cf

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
6 min	172522	2	0.95	0.7570	640	150	60	150	72
Point	↓	↓	-0.3	↓	↓	↓	↓	↓	↓
10.2	—	1	0.10	0.103	620	160	70	150	100
	173105	6.5	1.2	1.17	630	180	70	180	100
	1736.12	2.0	1.7	1.04	630	160	60	180	100
	1740.50	3.0	0.6	0.61	630	180	70	200	110
	174480	1.0	0.2	0.1148	620	160	80	250	120
	174772	1.0	0.1	0.0594	620	180	80	250	100
	1745.12	5.0	0.7	0.4014	620	150	75	270	100
	1749.52	6.6	-0.7	0.4014	620	180	75	270	100
	1749.91	9.0	-0.3	↓	↓	↓	↓	↓	↓
	—	—	-0.5	—	—		—		
K	175232	5.0	0.7	0.4014	620	180	80	275	100
TOTAL									
AVER.			0.596	0.463	624				100

KVB DS 60-13
Rev. 5/79

KVB

Test No. 7/17-2P
Engr. TIDONA/HART
FROHOFF/PIONESSA

STACK DATA

Date 7/16/80 Location SITE 7 Unit No. 11 A13 Fuel Refinery Gas & Oil
Load HIGH K#/hr or MBtu/hr ______ Filter No. 103A
Sample Box No. ________ Meter Box No. ______ Probe No. _____ Probe Length 6' SS
Stack Moisture 12 %
Ambient Temperature 99 °F
Nozzle Diameter .245 in.
Atmospheric Pressure 30.00 in.Hg
Stack Gas Pressure, Ps ___ iwg
Stack Area, As __________ ft^2

Remarks:
Final Meter: 1776.87
Initial Meter: 1750.46
26.41

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg) ✓	ΔH (iwg) ✓	T_s (°F) ✓	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
6	.5923	3	.6	.6779	680	170	80	250	100/105
6	.4115	2	.38	.4095	680	185	80	270	110/115
6	.3625	2	.3	.3176	640	185	90	270	110/115
0									
0	ZERO	Velocity	NO	SMAPLING					
18	.2094	1.5	.1	.1059	640	180	95	290	110/115
0	ZERO VELOCITY								
0									
18	.3625	3	.3	.3176	640	180	95	215	105/110
18	.4782	3	.45	.5532	660	190	80	260	105/110
0									
0	ZERO VELOCITY								
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

KVB

Test No. 7/17-3P
Engr. TIDONA/HATT

STACK DATA

Date 7/17/80 Location SITE 7 Unit No. 11H13 Fuel GAS/OIL
Load 16,500 Bbl/Dy K#/hr or MBtu/hr ______ Filter No. 104A
Sample Box No. ________ Meter Box No. ______ Probe No. _____ Brobe Length 6'SS
Stack Moisture 12 %
Ambient Temperature 92 °F
Nozzle Diameter .245 in.
Atmospheric Pressure 30.00 in.Hg
Stack Gas Pressure, Ps ___ iwg
Stack Area, As __________ ft²

Remarks:
Final Meter: 1808.45
Initial Meter: 1776.99
(31.46)

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0	ZERO	VELOCITY							
0									
18	.4975	2	.5	.6043	660	170	70	220	95/105
18	.3822	1.5	.3	.3564	660	190	75	240	100/105
0									
0	ZERO	VELOCITY							
0									
0	ZERO	VELOCITY							
18	.3788	1.5	.3	.3501	640	155	80	290	105/110
18	.4888	2	.5	.5831	640	165	85	310	105/110
0									
0	ZERO	VELOCITY							
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

KVB

Test No. 7/19-1FP
Engr. HART/TIDONA

STACK DATA

18 RT8-20-80
Date 7/~~21~~/80 Location SITE 7 Unit No. II A13 Fuel Gas/#6 Oil
Load 11,500 lbs/hr K#/hr or MBtu/hr ______ Filter No. 105 A
Sample Box No. ________ Meter Box No. ______ Probe No. _____ Probe Length 6' SS
Stack Moisture 12 %
Ambient Temperature ______ °F
Nozzle Diameter .245 in.
Atmospheric Pressure 30.00 in.Hg
Stack Gas Pressure, Ps ___ iwg
Stack Area, As _________ ft²

Remarks:
Final Meter: 1848.55
Initial Meter: 1808.50
40.05

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
6	.5183	3	.55	.6482	640	135	75	220	100/105
6	.5183	3	.55	.6482	640	135	80	240	100/105
6	.5183	3	.55	.6482	640	135	85	280	105/110
0									
0									
18		3	.54	.62	630	120	85	220	105/110
0									
0									
18		3	.5	.64	640	140	80	250	110/115
18		3	.45	.52	650	170	80	260	105/110
0									
0									
TOTAL									105/110
AVER.			0.510	0.6071	640				108

KVB DS 60-13
Rev. 5/79

Test No. 7/19-2P
Engr. HART

STACK DATA

Date 7/21/80 Location SITE 7 Unit No. 11 H13 Fuel GAS/OIL
Load N. 500 [illegible] K#/hr or MBtu/hr ______ Filter No. 106A
Sample Box No. ______ Meter Box No. ______ Probe No. ______ Probe Length 6' 55
Stack Moisture 14 %
Ambient Temperature 100 °F
Nozzle Diameter .245 in.
Atmospheric Pressure 29.93 in.Hg
Stack Gas Pressure, Ps ___ iwg
Stack Area, As ______ ft^2

Remarks:
Final Meter: 1879.62
Initial Meter: 1848.63
(30.99)

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
18			1.0	1.15	630	140	70	215	90/80
0									
0									
18			.85	.94	620	180	75	220	90/85
0									
0									
18			.9	1.05	640	195	65	235	90/95
0									
0									
18			.75	.88	640	200	75	270	95/100
0									
0									
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

KVB

Test No. 7/19-3P
Engr. HART

STACK DATA

Date 7/21/80 Location SITE 7 Unit No. 11H13 Fuel GAS/OIL RE #6
Load 11,500 KS/hr or MBtu/hr ______ Filter No. 107
Sample Box No. ______ Meter Box No. ______ Probe No. ______ Probe Length 6'SS
Stack Moisture 14 %
Ambient Temperature 104 °F
Nozzle Diameter .245 in.
Atmospheric Pressure 29.88 in.Hg
Stack Gas Pressure, Ps ___ iwg
Stack Area, As ______ ft^2

Remarks:
Final Meter: 1911.43
Initial Meter: 1879.62
(31.81)

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0									
0									
18		2	.5	.58	620	140	70	250	100/105
18		3	.85	1.0	620	150	75	250	100/105
0									
0									
0									
0									
18		2	.5	.58	620	170	80	240	100/105
18		3	.85	1.0	640	175	85	280	105/110
0									
0									
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

ANDERSEN CASCADE IMPACTOR DATA

Test No. 1 Location 7 Owner

Impactor No. Nozzle Size 0.250 Filter No. 567, 565, 563, 564, 562, 561, 560, 559, 581

Stack Temperature 750 °F Impactor Flow Rate 0.81 CFM

Filter #	Plate	Tare (g)	Final (g)	Net (g).	%	Cum. %	ECD (μ)
567	1	0.1981	0.2005	0.0024			
565	2	0.1886	0.1898	0.0012			
563	3	0.1931	0.1939	0.0008			
564	4	0.1855	0.1852	-0.0003			
562	5	0.1925	0.1938	0.0013			
561	6	0.1860	0.1831	-0.0029			
560	7	0.1954	0.1951	-0.0003			
559	8	0.1887	0.1878	-0.0009			
581	Back Up Filter	0.1839	0.1845	0.0006			

ANDERSEN CASCADE IMPACTOR DATA

Test No. 2 Location 7 Owner

Impactor No. Nozzle Size 0.250 Filter No.

Stack Temperature 650 °F Impactor Flow Rate 0.69 CFM

Filter #	Plate	Tare (g)	Final (g)	Net (g)	%	Cum. %	ECD (μ)	
572	1	0.1959	0.2003	0.0044	13.8	86.2	15.4	11.6
558	2	0.1848	0.1893	0.0045	14.2	72.0	9.7	7.3
573	3	0.1885	0.2019	0.0134	42.1	29.9	6.5	4.9
551	4	0.1858	0.1883	0.0025	7.9	22.0	4.5	3.4
571	5	0.1967	0.2000	0.0033	10.4	11.6	3.1	2.3
570	6	0.1880	0.1903	0.0023	7.2	4.4	1.5	1.1
568	7	0.1961	0.1974	0.0013	4.1	0.3	0.89	0.67
569	8	0.1871	0.1871	0.0000	0	0.3	0.60	0.45
582	Back Up Filter	0.1901	0.1902	0.0001	0.3	0	<0.60	<0.45

Total - 0.0318 g 100.0

Data Sheet 6002-5

ANDERSEN CASCADE IMPACTOR DATA

Test No. 3 Location 7 Owner

Impactor No. Nozzle Size 0.250 Filter No.

Stack Temperature 650 °F Impactor Flow Rate 0.70 CFM

Filter #	Plate	Tare (g)	Final (g)	Net (g)	%	Cum. %	ECD (μ)	
543	1	0.1978	0.2012	0.0034	13.2	86.8	15.4	11.6
542	2	0.1872	0.1910	0.0038	14.8	72.0	9.6	7.2
544	3	0.1963	0.2003	0.0040	15.6	56.4	6.3	4.7
548	4	0.1861	0.1904	0.0043	16.7	39.7	4.9	3.7
546	5	0.1927	0.1966	0.0039	15.2	24.5	2.8	2.1
547	6	0.1825	0.1835	0.0010	3.9	20.6	1.5	1.1
545	7	0.1958	0.1986	0.0028	10.9	9.7	0.89	.67
549	8	0.1850	0.1868	0.0018	7.0	2.7	0.59	.44
575	Back Up Filter	0.1892	0.1899	0.0007	2.7	0	<0.59	<.44
			Total =	0.0257	100.0			

Data Sheet 6002-5

ANDERSEN CASCADE IMPACTOR DATA

Test No. 4 Location 7 Owner

Impactor No. Nozzle Size 0.250" Filter No.

Stack Temperature 640 °F Impactor Flow Rate 0.70 CFM

Filter #	Plate	Tare (g)	Final (g)	Net (g)	%	Cum. %	ECD (µ)	
540	1	0.1945	0.2012	0.0067	19.6	80.3	15.4	11.6
538	2	0.1832	0.1894	0.0062	18.1	62.2	9.5	7.2
536	3	0.1949	0.2000	0.0051	14.9	47.3	6.2	4.7
532	4	0.1860	0.1905	0.0045	13.2	34.1	4.9	3.7
534	5	0.1972	0.1999	0.0027	7.9	26.2	2.8	2.1
537	6	0.1850	0.1885	0.0035	10.2	16.0	1.5	1.1
539	7	0.1933	0.1967	0.0034	9.9	6.1	0.89	.67
535	8	0.1955	0.1875	0.0020	5.8	0.3	0.58	.44
580	Back Up Filter	0.1976	0.1977	0.0001	0.3	0	<0.58	<.44

Total = 0.0342 g 99.9

Data Sheet 6002-5

ANDERSEN CASCADE IMPACTOR DATA

Test No. 5 Location 7 Owner

Impactor No. Nozzle Size 0.250 Filter No.

Stack Temperature 633 °F Impactor Flow Rate 0.70 CFM

Filter #	Plate	Tare (g)	Final (g)	Net (g)	%	Cum. %	ECD (μ)
556	1	0.1925	0.1962	0.0037			
505	2	0.1858	0.1882	0.0024			
550	3	0.1954	0.1957	0.0003			
555	4	0.2001	0.1976	−0.0025			
507	5	0.1864	0.1884	0.0020			
557	6	0.1942	0.1962	0.0020			
521	7	0.1842	0.1846	0.0004			
522	8	0.1949	0.1834	−0.0115			
52	Back Up Filter	0.1865	0.1855	−0.0010			

ANDERSEN CASCADE IMPACTOR DATA

Test No. 6 Location 7 Owner

Impactor No. Nozzle Size 0.250 Filter No.

Stack Temperature 625 °F Impactor Flow Rate 0.70 CFM

Filter #	Plate	Tare (g)	Final (g)	Net (g)	%	Cum. %	ECD (μ)	
503	1	0.1961	0.2008	0.0048	12.2	87.8	15.3	11.6
511	2	0.1851	0.1910	0.0059	15.0	72.8	9.5	7.2
527	3	0.1946	0.2001	0.0055	14.0	58.8	6.2	4.7
512	4	0.1882	0.1940	0.0058	14.7	44.1	4.9	3.7
506	5	0.1870	0.	0.0046	11.7	32.4	2.8	2.1
519	6	0.1870	0.1923	0.0053	13.4	19.0	1.4	1.1
526	7	0.1956	0.1993	0.0037	9.4	9.6	0.88	.67
522	8	0.1878	0.1903	0.0025	6.3	3.3	0.58	.44
579	Back Up Filter	0.1898	0.1911	0.0013	3.3	0	<0.58	<.44

Total = 0.0394 g 100.0

Data Sheet 6002-5

ANDERSON IMPACTOR
#1
AND #1

KVB

Test No. 7/17-1P
Engr. HART/TINOMA

STACK DATA

Date 7-16-80 Location SITE 7 Unit No. 11 H 13 Fuel ABsorb Gas/oil
Load — K#/hr or MBtu/hr — Filter No. —
Sample Box No. ______ Meter Box No. ______ Probe No. ______ Probe Length ______
Stack Moisture 12 %
Ambient Temperature 100 °F
Nozzle Diameter 0.25 in.
Atmospheric Pressure 30.00 in.Hg
Stack Gas Pressure, Ps — iwg
Stack Area, As — ft^2

Remarks:
Final Meter: 48.302
Initial Meter: 023.959

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0	0.81	9			750				110
10	0.81	15			750				105
30	0.81	17			750				100
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

ANDERSON IMPACTOR
#2

KVB

Test No. 7-17-2P
Engr. ______

AND #2

STACK DATA

Date 7-17-80 Location SITE 7 Unit No. 11H13 Fuel Alcol/OIL
Load ______ K#/hr or MBtu/hr ______ Filter No. ______
Sample Box No. ______ Meter Box No. ______ Probe No. ______ Probe Length ______
Stack Moisture 13.4 %
Ambient Temperature 65 °F
Nozzle Diameter 0.25 in.
Atmospheric Pressure 29.99 in.Hg
Stack Gas Pressure, Ps ______ iwg
Stack Area, As ______ ft²

Remarks:
Final Meter: 100.243
Initial Meter: 058.840
AVG ΔP = 0.32

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0	0.69	5.0			650				94
15	0.69	7.0							94
30	0.69	7.0							96
45	0.69	7.0							98
60	0.69	8.0			↓				99
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

ANDERSON IMPACTOR
No. # 3

KVB

Test No. 7/17-3
Engr. HART/TIDONA

AND. # 3

STACK DATA

Date 7-17-80 Location SITE 7 Unit No. ________ Fuel ADSORB/OIL
Load HIGH K#/hr or MBtu/hr ________ Filter No. ________
Sample Box No. ________ Meter Box No. ________ Probe No. ________ Probe Length ____
Stack Moisture 14 %
Ambient Temperature 100 °F
Nozzle Diameter 0.245 in.
Atmospheric Pressure ______ in.Hg
Stack Gas Pressure, Ps ____ iwg
Stack Area, As __________ ft^2

Remarks:
Final Meter: 143.420
Initial Meter: 101.419
Avg ΔP = 0.32
[illegible] 0.70
[illegible]
Final 245.1
Start 240.

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0	0.70	5.0							110
15	0.70	8.0							100
30	0.70	8.0							106
45	0.70	8.0							116
60	0.70	8.0							118
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

ANDERSON IMPACTOR
NO. # 4

AND # 4.

KVB

Test No. 7-19-1P
Engr. HART/TIDONA

STACK DATA

Date 7-18-80 Location SITE 7 Unit No. ____ Fuel Assoc Gas/oil

Load ____ K#/hr or MBtu/hr ____ Filter No. ____

Sample Box No. ____ Meter Box No. ____ Probe No. ____ Probe Length ____

Stack Moisture 14.6 %

Ambient Temperature 105 °F 15

Nozzle Diameter 0.250 in. T's

Atmospheric Pressure 30.00 in.Hg

Stack Gas Pressure, Ps ____ iwg

Stack Area, As ____ ft^2 0.70 cf-

Remarks:

Final Meter: 192.890

Initial Meter: 150887

AVG ΔP 0.32

Time	flow Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0	0.70	5							110
15	0.70	8							110
30	0.70	8							110
45	0.70	8							110
60	0.70	8							110
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

ANDERSON IMPACTOR
NO. #5

AND #5

KVB

ANDERSON #5

Test No. 7-19-20
Engr. HART

STACK DATA

Date 7-21-81 Location Site 7 Unit No. 1 H 13 Fuel ______
Load ______ K#/hr or MBtu/hr ______ Filter No. ______
Sample Box No. ______ Meter Box No. ______ Probe No. ______ Probe Length ______
Stack Moisture 14 %
Ambient Temperature 100 °F
Nozzle Diameter 0.250 in.
Atmospheric Pressure 29.93 in.Hg
Stack Gas Pressure, Ps ______ iwg
Stack Area, As ______ ft^2

Remarks:
Final Meter: 236.550
Initial Meter: 194.942

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0	0.7	5							110
15	0.7	7							110
30	0.7	7							110
45	0.7	7							110
60	0.7	7							110
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

ANDERSON IMPACTOR
#6

KVB

Test No. 7·19-SP
Engr. HART

STACK DATA

Date 7-21-80 Location SITE 7 Unit No. 11H13 Fuel ________

Load ________ K#/hr or MBtu/hr ______ Filter No. ________

Sample Box No. ______ Meter Box No. ______ Probe No. _____ Probe Length ____

Stack Moisture 14 %

Ambient Temperature 100 °F

Nozzle Diameter 0.250 in.

Atmospheric Pressure 2993 in.Hg

Stack Gas Pressure, Ps ____ iwg

Stack Area, As ________ ft^2

Remarks:

Final Meter: 280.960

Initial Meter: 238.959

Avg ΔP 0.32

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F)
0	0.7								
15	0.7								
30	0.7								
45	0.7								
60	0.7								
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

KVB
A Research-Cottrell Company

SO_x DATA SHEET (GOKSOYR-ROSS METHOD)

Test No. 7/18-2 Date 7-16-80 Location SITE 7

Unit No. 11 H 13 Fuel ABORB GAS / OIL

Capacity ______ Unit Type REFINERY CRUDE HEATER

Engr. HART/TIDONA Conditions ______

Meter Finish 10.099 P_{BAR} 30.00

Meter Start 08.590 % O_2 2.0 %

Sample Volume Collected = 1.509 ADCF

Start Time	Stop Time	Elapsed Time (minutes)
00:00	20:00	20.0 MIN.

Total Sampling Time = 20.00 min.

Elapsed Time	Meter Vac. ("Hg)	Temperatures (°F)					Sample Flow Rate (ADCFM)
		Meter	Coil In	Coil Out	Water Bath	Stack	
5.0	~~8.5~~ 0	106	120	127	163	738	0.075
10.0	~~9.0~~ 0.5	106	122	139	163	741	0.075
15.0	~~9.0~~ 0.5	106	130	140	163	739	0.075
20.0	~~9.0~~ 0.5	106	128	127	162	743	0.075

NOTES: (1) Sample flow rate at meter should be 0.075 ADCFM or 0.01 cf/8 secs.

(2) Total sample volume collected should be ~1.5 cf (~ 20 minutes sampling time).

Data Sheet KVB 6015-37
Rev.4/80

KVB
A Research-Cottrell Company

DATE 8-21-80

TEST NO. 7/18-2

SOx DATA SHEET

UNIT NO. 11H13 FUEL No.6 Oil + Ref. Gas LOAD 11,500 bbl/d LOCATION 7

Calculation: SO_3 or SO_2, ppm at stack O_2 = $\frac{(A - B) \times N \times F \times (460 + T) \times 24}{V\ (P + p)}$

Excess O_2 1.9 %

A = Ml of NaOH used for sample
B = Ml of NaOH used for blank
N = Normality of NaOH titrant
F = Dilution factor
T = Average temp. in gas meter, °F
V = Volume of gas sample, ft^3
P = Barometric pressure, in. Hg
p = Pressure in gas meter, in. Hg gage

	SO_2				SO_3				SO_x			
	#1	#2	#3									
A =	16.7	7.9	7.7		0							
B =	0	0	0		0							
N =	0.019	0.019	0.019		0.019							
F =	4.0	8.0	8.0									
T =	106				106							
V =	1.509				1.509							
P =	30.04				30.04							
p =	-0.5				-0.5							
Concentration, ppm at Stack O_2, dry =	387	366	357		0							
Average Concentration, ppm at 3% O_2, dry =	370 349				0				349			
lb/MBtu =												
ng/J =												

DATA SHEET NO. 60-14
Rev. 1/2/75
Rev. 2-3/25/80

LOCATION 7 - REFINERY PROCESS HEATER

SET 2, MARCH 31 - APRIL 23, 1981

PETROLEUM PROCESS HEATER

Location No. EPA # 6018 Unit No. 11-H-13

Unit Description NATURAL DRAFT CRUDE PROCESS HEATER WITH STAGED AIR LANCES

Installation Date 1974

Heater Rating 55×10^6 BTU/h / 16,250 BBL/DAY

Burner Description SIX (6) JOHN ZINK DBA-22 NATURAL DRAFT BURNERS

Test Fuel Combinations ADSORBER GAS + No. 6 OIL, ADSORBER GAS

Fuel Temp. at Burner (°F) AMBIENT, No. 6 OIL = 200°F

Primary Air Temp. (°F) AMBIENT

Comments:

MOBILE LABORATORY DATA

Test No. 1-1 = 1-5

Test No. 1-1 = 1-5 Date 3-31-81 Location ________ Engr. TIBONA

Unit No. 11 H 13 Fuel OIL Capacity 16,250 BBL/DAY - 55 x 10^6 BTU

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

1. Test No.	1-1		1-2		1-3		1-4		1-5	
2. Date	3-3-81		4-1-81		4-1		4-1		4-2-80	
3. Time	14:50		14:20		15:15		16:00		16:55	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		CENTER		→					
8. Oxygen (%)	4.8		5.8		5.8		5.6		6.0	
9. NOx (hot) read/3% O_2 (ppm)*	125		145		153		53		143	
10. NO (hot) read/3% O_2 (ppm)*	120		140		153		53		138	
11. NO_2 (hot) read/3% O_2 (ppm)*					0		0			
12. NO (cold) read/3% O_2 (ppm)*	153	170	168	199	172	204	70	82	165	198
13. Carbon Dioxide (%) CO_2	12.8%		13.2%.		12.8		13.6		12.0%	
14. Carbon Monoxide (ppm) CO uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	00S		00S		00S		00S		00S	
16. Sulfur Dioxide (ppm) uncor/cor*	46	58	90	61	68	91	0	0	40	54
17. Smoke Spot (Bacharach)	—		0.5							
18. Atmos. Temp. (°F/°C)	72°F		62°F		64°F		67°F		59°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.65		29.55		29.50		29.49		29.49	
21. Relative Humidity (%)	50%		66%		62%		50%		48%	
22.										
23.										
24. COMMENTS :										
25.	AS FOUND		AS FOUND		AS FOUND		AS FOUND		AS FOUND	
26.	3 OIL BURNER		6 OIL BURNERS		6 OIL GUNS		GAS FIRED		5 OIL BURNERS	
27.										
28.			CO_2 is?							
29.										
30.										

*Correction to 3% O_2 should not be performed if [PIONESSA] the value is measured on a wet basis.

Data Sheet 6002-2

* O.O.S - OUT OF SERVICE

Use 14% $H_2O(g)$ @ 2% O_2 as basis for calculating dry SO_2 values (i.e. % H_2O = 12% @ 4.8% O_2)

MOBILE LABORATORY DATA

Test No.

Test No. Date 4-2-81 Location Engr. TIDONA

Unit No. 11 H 13 Fuel OIL Capacity 16,250 BBL/DAY - 55 x 10^6 BTU

Unit Type CRUDE PROCESS HEATER Burner Type JOHN ZINK DBA-22

TECHS: A. FRUHOFF, J. PIONESSA

1. Test No.	2-1		2-2		2-2		2-3		2-4	
2. Date	4-2-81		4-2		4-2-81		4-2-81		4-2-81	
3. Time	11:40		12:25		14:15		15:35		16:05	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER →									
8. Oxygen (%)	5.5		4.3		4.4		2.2		0.5	
9. NOx (hot) read/3% O_2 (ppm)*	155		159		175		155		150	
10. NO (hot) read/3% O_2 (ppm)*	153		159		172		150		133	
11. NO_2 (hot) read/3% O_2 (ppm)*			0							
12. NO (cold) read/3% O_2 (ppm)*	181	215	200	216	210	228	193	185	163	143
13. Carbon Dioxide (%) CO_2	13.6%		14.4%		14.0%		17.2%		15.6%	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0		165	115
15. Hydrocarbon (ppm) uncor/cor*	OOS		OOS		OOS		OOS			
16. Sulfur Dioxide (ppm) uncor/cor*	127	167	120	148	108	133	0	0	142	147
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	58°F		58°F		60°F		57°F			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.49		29.46		29.47		29.49		29.45	
21. Relative Humidity (%)	64%		72%		72%		73%			
22.										
23.										
24. COMMENTS:	HIGH O_2		BASELINE		BASELINE		LOW O_2		LO LIMIT	
25.	6 OIL GUNS IN		OIL -		6 OIL GUNS IN		6 OIL GUNS IN		LOW O_2	
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

OOS - OUT OF SERVICE

MOBILE LABORATORY DATA Test No.________

Test No.__________ Date 4-3-81 Location____________________ Engr. TIRONA

Unit No. H H13 Fuel OIL Capacity 76,250 BBL/DAY - 55 x 10⁶ BTU

Unit Type CRUDE PROCESS HEATER Burner Type JOHN ZINK DBA-22

TECHS: A. FRONOFF - J. PIONESSA

1. Test No.	3-1		3-2							
2. Date	4/3/81		⟶							
3. Time	14:00		1640							
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		⟶							
8. Oxygen (%)	3.0		2.9							
9. NOx (hot) read/3% O_2 (ppm)*	93		131							
10. NO (hot) read/3% O_2 (ppm)*	93		131							
11. NO_2 (hot) read/3% O_2 (ppm)*	0		0							
12. NO (cold) read/3% O_2 (ppm)*	115	115	165	164						
13. Carbon Dioxide (%)	14.9		16.0							
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0						
15. Hydrocarbon (ppm) uncor/cor*	005		005							
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	178	204						
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	68 °F		70 °F							
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.68		29.64							
21. Relative Humidity (%)	53%		46%							
22.										
23.										
24.										
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No.__________ Date 4-6-81 Location__________________ Engr. TIDONA

Unit No. 11 H 13 Fuel OIL Capacity 16,250 BBL/DAY 55 X 10⁶ BTU

Unit Type CRUDE PROCESS HEATER Burner Type JOHN ZINK DBA-22

TECHS: J. PIONESSA, A. FRONOFF

1. Test No.	3-3		3-3		3-4		3-5			
2. Date	4-6-81		4-6-81		4-6-81		4-6-81			
3. Time	13:30		14:00		15:20		15:55			
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		CENTER							
8. Oxygen (%)	3.2		3.2		1.9%		0.35			
9. NOx (hot) read/3% O_2 (ppm)*	198		185		158		110			
10. NO (hot) read/3% O_2 (ppm)*	198		178		153		105			
11. NO_2 (hot) read/3% O_2 (ppm)*										
12. NO (cold) read/3% O_2 (ppm)*	213	215	213	215	185	174	138	121		
13. Carbon Dioxide (%)	16.4%		16.2%		18.0%		19.8%			
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	535	466		
15. Hydrocarbon (ppm) uncor/cor*	OOS		OOS		OOS	OOS	OOS			
16. Sulfur Dioxide (ppm) uncor/cor*	300	349	185	215	260	285	190	195		
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	80°F		84°F		81°F		80°F			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.46		29.48		29.44					
21. Relative Humidity (%)	46%		36%		40%		40%			
22.										
23.										
24. COMMENT:	BASELINE		BASELINE		MED-O_2		CO LIMIT			
25.	6 OIL GUN						LOW O_2			
26.	IN-NO									
27.	STAGED									
28.	AIR									
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

O.O.S. - OUT OF SERVICE

MOBILE LABORATORY DATA **Test No.**________

Test No.________ **Date** 4-7-81 **Location**________ **Engr.** TIDONA

Unit No. 11 H13 **Fuel** OIL **Capacity** 16,250 BBL/DAY 55 x 10^6 BTU

Unit Type CRUDE PROCESS HEATER **Burner Type** JOHN ZINK - DBA 22

TECHS & J. PIONESSO - A. [illegible]

1. Test No.	4-1		4-2		4-3		4-4		4-5	
2. Date	4-7-81		4-7-81		4-7		4-7		4-7	
3. Time			3:40		14:35		15:10		15:45	
4. Load	13:05									
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→		→		→		→	
8. Oxygen (%)	2.5		2.7		3.0		2.8		2.8	
9. NOx (hot) read/3% O_2 (ppm)*	178		168		157		138		160	
10. NO (hot) read/3% O_2 (ppm)*	170		163		157		138		153	
11. NO_2 (hot) read/3% O_2 (ppm)*					0		0			
12. NO (cold) read/3% O_2 (ppm)*	203	198	205	202	186	186	166	164	220	218
13. Carbon Dioxide (%)	17.6%		17.6%		17.3		16.0		16.2%	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	
15. Hydrocarbon (ppm) uncor/cor*	OOS		OOS		OOS		OOS		OOS	
16. Sulfur Dioxide (ppm) uncor/cor*	360	406	410	466	400	461	320	365	300	343
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	76°F		77°F		77°F		74°F		76°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.48		29.49		29.48		29.46		29.46	
21. Relative Humidity (%)	50%		46%		46%		58%		46%	
22.										
23.										
24. COMMENTS :	BASELINE		NATURAL DRAFT		N-DRAFT		N-DRAFT		BASELINE	
25.			STAGED AIR		STAGING		STAGING		NO STAGING	
26. # OF GUNS IN :	6		6		6		6		6	
27.	1 GUN IS SMOKING		1 SMOKING		60% OPEN		30% OPEN			
28.					2nd AIR		2'Y AIR			
29.					REGISTER		REGISTER			
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

O.O.S. - OUT OF SERVICE

MOBILE LABORATORY DATA

Test No.________

Test No.________ Date 4-8-81 Location________ Engr. TIDONA

Unit No. 11 H13 Fuel GAS Capacity 16,250 BBL/DAY 55 X10⁶ BTU

Unit Type CRUDE PROCESS HEATER Burner Type JOHN ZINK - DBA 22

TECHS J. PIONESSA

1. Test No.	5-1		5-1		5-2		5-3		5-4	
2. Date	4-8-81		4-8-81		4-8-81		4-8-81		4-8-81	
3. Time	09:35		10:35		11:10		11:30		11:55	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER →									
8. Oxygen (%)	2.5		2.9		1.7		1.85		1.8	
9. NOx (hot) read/3% O_2 (ppm)*	83		98		83		70		93	
10. NO (hot) read/3% O_2 (ppm)*	75		95		78		65		90	
11. NO_2 (hot) read/3% O_2 (ppm)*										
12. NO (cold) read/3% O_2 (ppm)*	98	95	113	112	113	105	110	104	115	108
13. Carbon Dioxide (%)	14.8%		15.0%		16.0%		16.0		16.0%	
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0	0	0
15. Hydrocarbon (ppm) uncor/cor*	OOS		OOS		OOS		OOS	OOS	OOS	
16. Sulfur Dioxide (ppm) uncor/cor*	10		20	23	0	0	60	65	0	0
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	71°F		74°F		76°F		76°F		76°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.60		29.62		29.62		29.65		29.65	
21. Relative Humidity (%)	46%		50%		52%		46%		41%	
22.										
23.										
24. COMMENTS 8	MAX		MAX		MAX STEAM		LOW STEAM		NO STEAM	
25.	STEAM		STEAM		LOW O_2		LOW O_2		LOW O_2	
26.	INJECTION		INJECTION							
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

O.O.S - OUT OF SERVICE

MOBILE LABORATORY DATA Test No.________

Test No.________ Date 4-8-81 Location________ Engr. TIDONA

Unit No. 11 H13 Fuel REASBOER BPS Capacity 16,250 BBL/DAY 55 X10⁶ BTU

Unit Type CRUDE HEATER Burner Type JOHN ZINK - DBA-22

TECH 8 S. PIONESSA

1. Test No.	5-5		5-6		5-7		5-8			
2. Date	4-8-81		→							
3. Time	12:20		12:30		12:55		13:30			
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→							
8. Oxygen (%)	2.3		2.6		3.0		3.1			
9. NOx (hot) read/3% O_2 (ppm)*	95		95		95		58			
10. NO (hot) read/3% O_2 (ppm)*	95		95		93		58			
11. NO_2 (hot) read/3% O_2 (ppm)*										
12. NO (cold) read/3% O_2 (ppm)*	121	116	123	120	115	115	70	70		
13. Carbon Dioxide (%)	15.2%		15.2%		14.8%		14.8%			
14. Carbon Monoxide (ppm) uncor/cor*	0	0	0	0	0	0	0	0		
15. Hydrocarbon (ppm) uncor/cor*	005		005		005		005			
16. Sulfur Dioxide (ppm) uncor/cor*	0	0	0	0	20	23	25	29		
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	73°F		74°F		72°F		75°F			
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.65		29.65		29.65		29.65			
21. Relative Humidity (%)	60%		58%		48%		48%			
22.										
23.										
24. COMMENTS 8	2.3 O_2		BASELINE		LOW STEAM		NATURAL STAGING		DRAFT	
25.							AIR REGST		ADJ.	
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

O.O.S. - OUT OF SERVICE

MOBILE LABORATORY DATA

Test No. 6-1 TO 6-5

Test No. 6-1 TO 6-5 Date 4/20/81 Location ______ Engr. B. TIDONA

Unit No. 11 H 13 Fuel ______ Capacity 16250 BSD/DAY 55 X 10⁶ BTU

Unit Type CRUDE PROCESS HEATER Burner Type JOHN ZINK BRC-22

1. Test No.	6-1		6-2		6-3		6-4		6-5	
2. Date	4/20/81		→		6-21-81		→			
3. Time	1600		1705		09:30		10:15		10:45	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→							
8. Oxygen (%)	3.8		4.0		3.7		3.9		3.7	
9. NOx (hot) read/3% O_2 (ppm)*	187		162		160		158		146	
10. NO (hot) read/3% O_2 (ppm)*	187		162		160		158			
11. NO_2 (hot) read/3% O_2 (ppm)*	0		0		0		0			
12. NO (cold) read/3% O_2 (ppm)*	232	243	203	215	195	203	187	197	181	188
13. Carbon Dioxide (%)	003	→								
14. Carbon Monoxide (ppm) uncor/cor*	10	10	10	11	10	10	10	11	10	10
15. Hydrocarbon (ppm) uncor/cor*	005	→								
16. Sulfur Dioxide (ppm) uncor/cor*	245	293	180	218	195	232	180	217	185	220
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. [✓ °F]/°C)	66°F		68		70		67		67	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.66		29.67		29.68		29.66			
21. Relative Humidity (%)	62		70		58		62		62	
22.										
23. STAGED AIR SCFM	—		1897		—		1718		2246	
24.										
25. COND:	Baseline		STAGED		NEW Baseline		STAGED		STAGED	
26.			AIR REG				AIR REG.		AIR REG	
27.			160%				33% OPEN		33% OPEN	
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No.__________ Date 4-21-81 Location____________________ Engr. TIRONA

Unit No. 11 H13 Fuel #6 OIL Capacity 16250 BBL/DAY 55 X 10^6 BTU

Unit Type CRUDE PROCESS HEATER Burner Type JOHN ZINK DBA-22

1. Test No.	6-6		6-7		6-8		6-9		6-10	
2. Date	4-21-81		→		→		→			
3. Time	11:20		1205		1440		1550		16:20	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	CENTER		→		→		→			
8. Oxygen (%)	3.8		3.9		3.6		3.6		3.7	
9. NOx (hot) read/3% O_2 (ppm)*	135		126		129		122		104	
10. NO (hot) read/3% O_2 (ppm)*	135		126		129		122		104	
11. NO_2 (hot) read/3% O_2 (ppm)*	0		0		0		0		0	
12. NO (cold) read/3% O_2 (ppm)*	164	172	157	165	161	167	148	153	135	140
13. Carbon Dioxide (%)	00S	→	→		→		→		→	
14. Carbon Monoxide (ppm) uncor/cor*	10	10	10	11	10	10	10	10	10	10
15. Hydrocarbon (ppm) uncor/cor*	00S	→	→		→		→		→	
16. Sulfur Dioxide (ppm) uncor/cor*	190	227	215	259	180	213	180	213	180	214
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	66°F		70°F		69°F		71°F		71°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.66		29.64		29.58		29.56		29.55	
21. Relative Humidity (%)	62		68		62		62		62	
22.										
23. COND:	STAGED		STAGED		STAGED		STAGED		STAGED	
24. STAGGED AIR FLOW SCFM	2957		3174		3152		3245		3240	
25.	AIR REG		AIR REG.		AIR REG		AIR REG		AIR REG	
26.	25% OPEN		10% OPEN		10% OPEN		10% OPEN		10% OPEN	
27.					TERTIARY		TANGENTIAL		TERT AIR	
28.					AIR @ 45°		TERT. AIR		AWAY FR	
29.					TO RIGHT OF				BURNERS	
30.					CENTER					

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

REFER TO PM BASELINE

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No.

Test No. Date 4-21-81 Location Engr. TIDONA

Unit No. 11 H 13 Fuel OIL/GAS Capacity 16250 bbl/dy 5.5 x 10^6 BTU

Unit Type CRUDE HTR Burner Type ZINK DBA 22

1. Test No.	6-11									
2. Date	4-21									
3. Time	1645									
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	C →									
8. Oxygen (%)	3.9									
9. NOx (hot) read/3% O_2 (ppm)*	158									
10. NO (hot) read/3% O_2 (ppm)*	158									
11. NO_2 (hot) read/3% O_2 (ppm)*	0									
12. NO (cold) read/3% O_2 (ppm)*	201	212								
13. Carbon Dioxide (%)	OOS →									
14. Carbon Monoxide (ppm) uncor/cor*	10	11								
15. Hydrocarbon (ppm) uncor/cor*	OOS →									
16. Sulfur Dioxide (ppm) uncor/cor*	180	217								
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	72°F									
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.56									
21. Relative Humidity (%)	66									
22.										
23. STAGED AIR SCFM	—									
24. COND.	REPEAT									
25.	Baseline									
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA

Test No. 7-1 TO 7-5

Test No. 7-1 TO 7-5 Date 4-22-81 Location ____ Engr. ____

Unit No. 11 H 13 Fuel OIL / GAS Capacity 16250 bbl/dy 5.5x10⁶ BTU

Unit Type CRUDE HTR Burner Type ZINK DBA 22

1. Test No.	7-1		7-2		7-3		7-4		7-5	
2. Date	4-22 →								→	
3. Time	09:05		10:30		11:25		11:15		13:55	
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	C →								→	
8. Oxygen (%)	4.1		1.8		1.7		1.8		1.9	
9. NOx (hot) read/3% O_2 (ppm)*	172		135		123		95		85	
10. NO (hot) read/3% O_2 (ppm)*	172		135		123		95		85	
11. NO_2 (hot) read/3% O_2 (ppm)*	0		0		0		0		0	
12. NO (cold) read/3% O_2 (ppm)*	201	214	165	155	157	145	117	110	107	101
13. Carbon Dioxide (%)	OOS →								→	
14. Carbon Monoxide (ppm) uncor/cor*	10	11	20	19	20	19	27	25	20	19
15. Hydrocarbon (ppm) uncor/cor*	OOS →								→	
16. Sulfur Dioxide (ppm) uncor/cor*	210	256	225	245	220	239	245	267	290	318
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	70°F		71°F		79°F		81°F		82°F	
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.62		29.62		29.60		29.60			
21. Relative Humidity (%)	60		72		42		46		32	
22.										
23. STAGED AIR FLOW ACFM	—		—		1675		2542		3121	
24. COND:	BASELINE		LOW O_2		LOW STAGED		MED STAGED		HIGH STAGED	
25.			BASELINE		LOW O_2		LOW O_2		LOW O_2	
26.	AIR REG.		AIR REG.		AIR REG.		AIR REG.		AIR REG.	
27.	33% OPEN		33% OPEN		33% OPEN		10% OPEN		10% OPEN	
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA Test No.________

Test No. 7- Date 4 -22 Location____________________ Engr. TIDONA

Unit No. 11H13 Fuel OIL/GAS Capacity 16250 bbl/dy 5.5X10^6 BTU

Unit Type CRD HTR Burner Type ZINK DBA 22

1. Test No.	7-6 ~~6-2~~									
2. Date	4-22									
3. Time	1620									
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	C →									
8. Oxygen (%)	4.0									
9. NOx (hot) read/3% O_2 (ppm)*	174									
10. NO (hot) read/3% O_2 (ppm)*	174									
11. NO_2 (hot) read/3% O_2 (ppm)*	0									
12. NO (cold) read/3% O_2 (ppm)*	208	220								
13. Carbon Dioxide (%)	oos									
14. Carbon Monoxide (ppm) uncor/cor*	10	11								
15. Hydrocarbon (ppm) uncor/cor*	oos									
16. Sulfur Dioxide (ppm) uncor/cor*	235	284								
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	84									
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.54									
21. Relative Humidity (%)	52									
22.										
23. COND:	REPEAT									
24.	BASELINE									
25.										
26.										
27.										
28.										
29.										
30.										

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

MOBILE LABORATORY DATA **Test No.** 7 -

Test No. 7 - **Date** 4-23-81 **Location** ____ **Engr.** TIDONA

Unit No. 11 H 13 **Fuel** OIL / GAS **Capacity** 16250 bbl/d 5.5 x 10^6 BTU

Unit Type CRD HTR **Burner Type** ZINK DBA 22

1. Test No.	8-1		8-1P		8-1					
2. Date	4-23		4-23		4-23					
3. Time	1305		17:30		1835					
4. Load										
5. Process Rate										
6. Flue Diam. or Size, ft										
7. Probe Position	C →									
8. Oxygen (%)	3.9		1.9		4.0					
9. NOx (hot) read/3% O_2 (ppm)*	150		85		167					
10. NO (hot) read/3% O_2 (ppm)*	150		75		167					
11. NO_2 (hot) read/3% O_2 (ppm)*	0				0					
12. NO (cold) read/3% O_2 (ppm)*	190	200	95	90	213	226				
13. Carbon Dioxide (%)	OOS →									
14. Carbon Monoxide (ppm) uncor/cor*	15	16	20	19	10	11				
15. Hydrocarbon (ppm) uncor/cor*	OOS →									
16. Sulfur Dioxide (ppm) uncor/cor*	136	164	220	241	230	278				
17. Smoke Spot (Bacharach)										
18. Atmos. Temp. (°F/°C)	91°F		89°F							
19. Dew Point Temp. (°F/°C)										
20. Atmos. Pressure (in. Hg)	29.55		29.55							
21. Relative Humidity (%)	50		42%							
22.										
23. STAGED AIR FLOW ACFM	—									
24.										
25. COND:	BASELINE		LOW NOx		BASELINE					
26.	WITH #5		PARTICULATE		USE					
27.	BURNER		RANGE		THIS					
28.	OOS.		FIRING							
29.	W/OUT		TOWARD HEATER							
30.	OIL FIRE		CENTER LINE							

*Correction to 3% O_2 should not be performed if the value is measured on a wet basis.

Data Sheet 6002-2

UNIT OPERATING DATA

st No. 1-1 to 1-5 Date ______ Location ______ Engr. TIDONA

Unit No. 11H13 Fuel ADSORBER GAS No.6 Oil Capacity 16350 bbl/d, 55×10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description: AS FOUND

1. Test Number	1-1	1-2	1-3	1-4	1-5
2. Date	3-31-81	4-1-81	4-1-81	4-1-81	4-2-81
3. Time	14:50	14:20	15:15	16:00	10:55
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	(10,900 bpd) 5.9	5.9	5.9	5.9	5.95
6. Crude T_{in} (°F)	354	360	360	360	360
7. Crude T_{out} (°F) East	618	638	626	638	632
8. Crude T_{out} (°F) West	630	631	633	644	634
9. Crude P_{in} (psig) East	130	130	130	132	131
10. Crude P_{in} (psig) West	132	125	122	125	125
11. Crude P_{out} (psig)	30	30	30	30	30
12. Reabsorber gas in x ~~205.056~~ [illegible] (10^3 scf/d) [illegible]	(481,200 scfd) 2.8	2.4	2.3	3.6	2.7
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	—	—
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	0/0	36/56	36/56	0/138	41/71
17. Burner #2	27/56	30/56	30/56	0/134	32/72
18. Burner #3	26/52	29/53	29/53	0/132	33/69
19. Burner #4 Stm gauge ?	0/0	31/38	31/39	0/88	37/75
20. Burner #5	33/53	30/54	30/54	0/131	34/69
21. Burner #6	0/0	33/43	33/43	0/116	0/0

UNIT OPERATING DATA - CONTINUED

Test No.______ Date______ Location______ Engr.______

Unit No.______ Fuel______ Capacity______

Unit Type______ Burner Type______

Test Description:	1-1	1-2	1-3	1-4	1-5
22. °2 air flow total P	—	—	—	—	—
23. Gas P to Burner #1 (psig)	8.3	4.8	3.2	8.7	8.3
24. " P to Burner #2	4.0	4.0	8.3	7.5	5.4
25. P to Burner #3	4.3	3.4	5.0	9.4	6.9
26. P to Burner #4	8.9	10.1	1.7	6.7	6.4
27. P to Burner #5	4.1	2.5	4.0	9.9	1.7
28. P to Burner #6	9.5	2.6	4.5	9.8	6.1
29. Staging height (ft)	—	—	—	—	—
30. °2 air damper, % open	—	—	—	—	—
. °2 air T (°F) #1	—	—	—	—	—
32. °2 air T (°F) #2	—	—	—	—	—
33. °2 air T (°F) #3	—	—	—	—	—
34. Stack T (°F)	691	735	729	737	743
35. Fuel Oil T (°F)	200	199	199	199	192
36. Stack Damper Indicated * (% open)	89	89	89	81	89
37. Bottom Furnace P (iwg)	O.O.S	O.O.S	O.O.S.	O.O.S	O.O.S.
38. Convective P (iwg)	O.O.S.	"	"	"	"
39. Stack P (iwg)	O.O.S	"	"	"	"
40. Air Registers (% open)	~40	~40	~40	~40	~40
41. Crude API Gravity	—	24.4	24.4	24.4	24.4
42. Flame Observations	Oil flames [illegible] and narrow Gas: flames blue	Oil flames look good, long & narrow		Atomizing STM ONLY	
43. Other Observations	3 oil guns plugged	all 6 burners firing some oil	a little less gas →	No Oil	1 oil gun O.O.S.

* Dpr setting is indicated, not actual.

lances in; butterfly closed but ball valves open.

ball valves closed

Page 3

UNIT OPERATING DATA

Test No._______

Test No._______ **Date**_______ **Location**_______ **Engr.**_______

Unit No._______ **Fuel**_______ **Capacity**_______

Unit Type_______ **Burner Type**_______

	1-1	1-2	1-3	1-4	1-5
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr P (psig)					
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve %open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve %open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)					42
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	740/714	744/728	753/721	740/735	734/708
18. Tube 15 Pass A/Pass B	718/699	720/709	729/701	721/711	713/681
19. Tube 20 Pass A/Pass B	732/737	733/748	740/724	735/746	730/725
20. Tube 25 Pass A/B (outlet)	767/765	765/774	767/764	762/775	763/763
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No.______ Date______ Location______ Engr.______

Unit No. 11 H 13 Fuel______ Capacity 16350 bbl/d, 55 x 10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DPA-22

Test Description: High O_2 Baseline ⟶ | Low O_2 CC L[illegible]

1. Test Number	2-1	2-2	2-2	2-3	2-4
2. Date	4-2-81	4-2-81	4-2-81	4-2-81	4 2 81
3. Time	11:40	12:25	14:15	15:35	16:05
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	5.95	5.95	5.9	5.9	5.9
6. Crude T_{in} (°F)	364	364	366	364	363
7. Crude T_{out} (°F) East	643	633	635	634	643
8. Crude T_{out} (°F) West	643	632	634	634	647
9. Crude P_{in} (psig) East	132	132	132	131	131
10. Crude P_{in} (psig) West	123	122	123	124	121
11. Crude P_{out} (psig)	30	30	30	30	30
12. Reabsorber gas in x ~~[illegible]~~ 176.[illegible] (10^3 scf/d)	2.6	2.5	2.5	2.6	2.5
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	-	—
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	42/71	42/69	42/70	36/64	36/64
17. Burner #2	33/72	31/70	32/71	27/64	22/66
18. Burner #3	34/69	33/67	34/68	28/61	29/61
19. Burner #4	38/72	36/71	37/71	32/62	33/62
20. Burner #5	34/69	34/67	33/68	26/63	26/63
21. Burner #6	40/58	37/56	38/57	32/51	33/51

UNIT OPERATING DATA - CONTINUED

Test No.________ **Date**________ **Location**________ **Engr.**________

Unit No.________ **Fuel**________ **Capacity**________

Unit Type________ **Burner Type**________

Test Description:	2-1	2-2	2-2	2-3	2-4
22. °2 air flow total P	—	–	–	—	–
23. P to Burner #1	7.2	7.0	6.6	7.3	7.1
24. P to Burner #2	4.1	4.1	4.0	4.9	4.5
25. P to Burner #3	5.9	5.7	5.4	6.1	5.9
26. P to Burner #4	5.5	5.4	5.1	5.8	5.6
27. P to Burner #5	1.6	1.6	1.6	1.6	1.6
28. P to Burner #6	5.4	5.2	5.0	5.5	5.3
29. Staging height (ft)	—	—	—	–	—
30. °2 air damper, % open	—	—	–	—	–
. °2 air T (°F) #1	—	—	–	—	—
32. °2 air T (°F) #2	—	–	–	–	–
33. °2 air T (°F) #3	—	–	–	—	—
34. Stack T (°F)	750	716	715	692	673
35. Fuel Oil T (°F)	192	192	193	193	193
36. Stack Damper (~~% open~~ indication)	89	79	79	71	68
37. Bottom Furnace P (iwg)	0.0.S.	0.0.S	-0.02	varying	varying
38. Convective P (iwg)	"	"	0.0	"	"
39. Stack P (iwg)	"	"	0.0	"	"
40. Air Registers (% open)	~40	~40	~40	~40	~40
41. Crude API Gravity	24.4	24.4	24.4	24.4	24.4
42. Flame Observations	All flames brt yel. narrow	flame heights ~8 to 10 ft.	No. 2 brn flame a little weak	flames lazier heights >10 ft	Smoking, billowy [illegible]
43. Other Observations	All 6 brns firing oil			lower oil flow unit going off control on gas so gas flow was increased.	

Page 3

UNIT OPERATING DATA **Test No.**________

Test No.________ **Date**________ **Location**________ **Engr.**________

Unit No.________ **Fuel**________ **Capacity**________

Unit Type________ **Burner Type**________

	2-1	2-2	2-2	2-3	2-4
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr. P (psig)					
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)	42	42	42	36	36
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	742/720	738/716	738/717	753/724	748/725
18. Tube 15 Pass A/Pass B	723/695	715/694	717/696	726/705	725/712
19. Tube 20 Pass A/Pass B	738/733	735/732	733/736	743/736	746/745
20. Tube 25 Pass A/B (outlet)	771/778	776/776	771/773	784/791	784/788
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No.________ Date________ Location________ Engr. TIDONA

Unit No. 11 H 13 Fuel ADSORBER GAS / NO.6 OIL Capacity 16350 bbl/d, 55 x 10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description: GAS BASELINE | GAS + OIL BASELINE

1. Test Number	3-1	3-2			
2. Date	4-3-81	4-3-81			
3. Time	14:00	15:45			
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	(13,673) 7.4	7.4			
6. Crude T_{in} (°F)	344	345			
7. Crude T_{out} (°F) East	651	651			
8. Crude T_{out} (°F) West	644	645			
9. Crude P_{in} (psig) East	155	154			
10. Crude P_{in} (psig) West	149	148			
11. Crude P_{out} (psig)	37.5	38.0			
12. Reabsorber gas in x 205.856 (10^3 scf/d) [illegible] x .8348	(799) 4.65	2.6			
13. Natural gas in x 169.044 (10^3 scf/d)	—	—			
14. Fuel oil in	NONE				
15. Fuel P/steam P (psig)					
16. Burner #1		55/81			
17. Burner #2		47/81			
18. Burner #3		46/78			
19. Burner #4		53/67			
20. Burner #5		49/79			
21. Burner #6		50/67			

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description: 3-1 3-2

22. °2 air flow total P	—	—			
23. P to Burner #1	15.2	4.5			
24. P to Burner #2	14.0	4.3			
25. P to Burner #3	15.8	5.1			
26. P to Burner #4	17.0	Bad Gauge			
27. P to Burner #5	16.3	5.1			
28. P to Burner #6	16.6	5.3			
29. Staging height (ft)	—	—			
30. °2 air damper, % open	—	—			
. °2 air T (°F) #1	—	—			
32. °2 air T (°F) #2	—	—			
33. °2 air T (°F) #3	—	—			
34. Stack T (°F)	793	774			
35. Fuel Oil T (°F)	—	196			
Indicated at dpr position? 36. Stack Damper (% open)	60	60			
37. Bottom Furnace P (iwg)	-0.35	0.05			
Top of Htr. 38. Convective P (iwg)	> 0.1	"			
39. Stack P (iwg)	+ 0.1	"			
40. Air Registers (% open)	100	100			
41. Crude API Gravity	22.5	22.5			
42. Flame Observations	Yellow flames ~10' height	Smoky firebox visible smoke at stack			
43. Other Observations	GAS ONLY NO AIR	OIL IN ALL BURNERS			

Wet indication at bottom of heater

Page 3

UNIT OPERATING DATA **Test No.**______

Test No.______ **Date**______ **Location**______ **Engr.**______

Unit No.______ **Fuel**______ **Capacity**______

Unit Type______ **Burner Type**______

	3-1	3-2				
1. Test Number						
2. Date						
3. Time						
4. Load						
5. Process Rate						
6. FUEL Oil Tank Level						
7. Oil Tank Level (bbl)						
8. ~~Fuel~~ Absorber Gas Hdr P (psig)	49	50				
9. Fuel Gas Brn Man. P (psig)						
10. Fuel Gas Control Valve % open						
11. Gas Control Valve ΔP (psi)						
12. Fuel Oil Control Valve % open						
13. Oil Valve Inlet P (psig)						
14. Oil Valve Outlet P (psig)		52				
15. Oil Valve ΔP (psi)						
16. Tube Skin Temps. (°F)						
17. Tube 13 Pass A/Pass B	809/ 794	804/ 810				
18. Tube 15 Pass A/Pass B	765/ O.O.S.	764/ 741				
19. Tube 20 Pass A/Pass B	800/ 797	791/ 822				
20. Tube 25 Pass A/B (outlet)	817/ 823	841/ 852				
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						

Data Sheet 6002-1

UNIT OPERATING DATA

..st No.______ Date______ Location______ Engr. TIDONA

Unit No. 11 H 13 Fuel No 6 OIL + ADSORBER GAS Capacity 16350 bbl/d, 55 x 10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DPA-22

Test Description: HIGH LOAD O₂ SWING | GAS + OIL BASELINE → | MED. LO O₂ | CO Limit

1. Test Number	3-3	3-3	3-4	3-5	
2. Date	4-6-81	4-6-81	4-6-81	4-6-81	
3. Time	13:30	14:00	15:20	15:55	
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.4	7.4	7.4	7.4	
6. Crude T_{in} (°F)	343	343	344	342	
7. Crude T_{out} (°F) East	645	645	638	634	
8. Crude T_{out} (°F) West	649	644	647	649	
Crude P_{in} (psig) East	150	151	150	148	
10. Crude P_{in} (psig) West	145	145	144	141	
11. Crude P_{out} (psig)	34.5	34.5	34.0	35.0	
12. Reabsorber gas in x 205.856 (10^3 scf/d) x .8348	2.4	2.4	2.2	2.2	
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	—	
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	62/87	62/87	62/88	62/87	
17. Burner #2	55/87	55/88	55/88	55/88	
18. Burner #3	53/84	53/84	54/84	54/84	
19. Burner #4	60/73	60/74	60/73	60/73	
20. Burner #5	56/84	56/85	56/85	53/85	
21. Burner #6	58/73	58/74	58/74	58/74	

UNIT OPERATING DATA - CONTINUED

t No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description: 3-3 3-3 3-4 3-5

22. °2 air flow total P	—	—	—	—	
23. P to Burner #1	3.1	3.2	2.2	2.6	
24. P to Burner #2	13.2	13.1	9.9	10.5	
25. P to Burner #3	3.8	3.8	3.0	3.3	
26. P to Burner #4	5.2	5.1	4.7	4.4	
27. P to Burner #5	4.0	4.0	3.5	3.8	
28. P to Burner #6	4.0	4.0	3.2	3.6	
29. Staging height (ft)	—	—	—	—	
30. °2 air damper, % open	—	—	—	—	
. °2 air T (°F) #1	—	—	—	—	
32. °2 air T (°F) #2	—	—	—	—	
33. °2 air T (°F) #3	—	—	—	—	
34. Stack T (°F)	784	783	757	720	
35. Fuel Oil T (°F)	193	193	193	193	
36. Stack Damper* (% open)	100	100	90	80	
37. Bottom Furnace P (iwg)	-0.40	-0.40	-0.33	-0.25	
38. Convective P (iwg)	-0.02	-0.03	+0.06	+0.12	
39. Stack P (iwg)	-0.03	-0.03	-0.03	-0.02	
40. Air Registers (% open)	100	100	100	100	
41. Crude API Gravity	20.8	20.8	20.8	20.8	
42. Flame Observations	Flames look good No. 5 Brn smoky	Flame heights ~ 8 ft.	Brn. # 5 Smoky	Lots of visible smoke at stack	
3. Other Observations	No stack vis. emissions	No. 5 Brn still smoky			

* Indication at Bottom of Heater

Page 3

UNIT OPERATING DATA **Test No.**______

Test No.______ **Date**______ **Location**______ **Engr.**______

Unit No.______ **Fuel**______ **Capacity**______

Unit Type______ **Burner Type**______

	3-3	3-3	3-4	3-5	
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psi)	–	–	50	50	
9. Fuel Gas Brn Man. P (psi)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psi)					
14. Oil Valve Outlet P (psi)	60	60	60	60	
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	806/ 802	802/799	811/ 776	845/ 775	
18. Tube 15 Pass A/Pass B	771/ O.O.S.	769/ O.O.S.	778/ 744	820/ O.O.S.	
19. Tube 20 Pass A/Pass B	796/810	786/814	798/808	823/ 810	
20. Tube 25 Pass A/B (outlet)	841/ 839	834/840	850/854	873/ 868	
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No.________ Date________ Location________ Engr.________

Unit No. 11 H 13 Fuel ABS GAS + NO6 OIL Capacity 16250 bbl/d, 55 x10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description:	BASELINE	STAGED AIR NATURAL DRAFT	REG. ADJ. →	REG. ADJ. →	REPEAT BASELINE
1. Test Number	4-1	4-2	4-3	4-4	4-5
2. Date	4-7-81	4-7-81	4-7-81	4-7-81	4-7-81
3. Time	13:05	13:40	14:35	15:10	15:45
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.45	7.45	7.45	7.45	7.45
6. Crude T_{in} (°F)	342	343	342	344	343
7. Crude T_{out} (°F) East	645	639	641	644	644
8. Crude T_{out} (°F) West	644	641	645	643	643
9. Crude P_{in} (psig) East	149	149	147	148	145
10. Crude P_{in} (psig) West	140	140	139	140	139
11. Crude P_{out} (psig)	34.0	34.0	33.5	33.5	34.0
12. Reabsorber gas in x 205.856 (10^3 scf/d) x.9348	2.2	2.3	2.4	2.3	2.4
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–	–	–
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	62/86	62/86	62/86	62/86	62/86
17. Burner #2	55/87	55/87	55/88	55/87	55/87
18. Burner #3	53/84	53/84	54/84	54/83	54/83
19. Burner #4	60/75	60/75	60/75	60/75	60/75
20. Burner #5	56/84	51/85	51/85	51/84	51/84
21. Burner #6	58/73	58/73	58/73	58/73	58/73

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:	4-1	4-2	4-3	4-4	4-5
22. *2 air flow total P	–	–	–	–	–
23. P to Burner #1	2.6	3.0	3.2	3.0	2.8
24. P to Burner #2	11.2	13.0	13.2	12.9	12.5
25. P to Burner #3	3.3	3.7	3.8	3.6	3.5
26. P to Burner #4	3.9	4.1	4.2	4.0	4.0
27. P to Burner #5	3.7	4.0	4.2	4.0	4.0
28. P to Burner #6	3.4	3.9	3.9	3.6	3.6
29. Staging height (ft)	–	–	–	–	–
30. *2 air damper, % open	–	–	–	–	–
. *2 air T (°F) #1	–	–	–	–	–
32. *2 air T (°F) #2	–	–	–	–	–
33. *2 air T (°F) #3	–	–	–	–	–
34. Stack T (°F)	772	773	778	771	776
35. Fuel Oil T (°F)	198	198	198	198	198
36. Stack Damper* (% open)	90	88	88	100	90
37. Bottom Furnace P (iwg)	-0.38	-0.23	-0.33	-0.47	-0.36
38. Convective P (iwg)	+0.03	+0.15	+0.06	-0.07	+0.02
39. Stack P (iwg)	-0.02	-0.01	0.0	-0.04	-0.01
40. Air Registers (% open)	100	100	60	30	100
41. Crude API Gravity	21.0	21.0	21.0	21.0	21.0
42. Flame Observations	Brn. #5 Smoky	[illegible] slightly to #5, still smoky but	Nr. 5 still smoky Other flames	All flames lazy, wide, & smoky	as in #4-1
43. Other Observations	flame height ~10 ft	better Pipe Caps 0S4	good; slightly lazier than before longer flames	flames entangling at viewport level	No entangling of flames

* Indication at bot. of htr.

Page 3

UNIT OPERATING DATA **Test No.**_______

Test No._______ **Date**_______ **Location**_______ **Engr.**_______

Unit No._______ **Fuel**_______ **Capacity**_______

Unit Type_______ **Burner Type**_______

	4-1	4-2	4-3	4-4	4-5
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)					
9. Fuel Gas Brn Man. P (psig)	49	49	49	49	49
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)	60	60	60	60	60
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	818/792	805/788	803/787	814/790	807/784
18. Tube 15 Pass A/Pass B	771/0.0.S.	770/773	765/762	784/776	771/760
19. Tube 20 Pass A/Pass B	792/831	784/817	788/814	805/816	786/796
20. Tube 25 Pass A/B (outlet)	840/850	832/839	835/841	848/847	829/830
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

it No.________ Date________ Location________ Engr. Tidball

Unit No. 11 H 13 Fuel ADSORBER GAS Capacity 16250 bbl/d, 55×10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description:	MAXIMUM STM INJ.	MAX. STM. INJ.	MAX. STM. LOW O₂	LOW STM LOW O₂	NO STM LOW O₂
1. Test Number	5-1	5-1	5-2	5-3	5-4
2. Date	4-8-81	4-8-81	4-8-81	4-8-81	4-8-81
3. Time	09:35	10:35	11:10	11:30	12:00
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.4	7.4	7.4	7.4	7.4
6. Crude T_{in} (°F)	343	346	345	343	343
7. Crude T_{out} (°F) East	631	659	644	637	636
8. Crude T_{out} (°F) West	662	652	634	633	635
9. Crude P_{in} (psig) East	148	147	150	148	145
10. Crude P_{in} (psig) West	139	139	140	139	137
11. Crude P_{out} (psig)	33.5	34.0	33.5	33.0	33.0
12. Reabsorber gas in x ~~305.856~~ 121.[illegible] (10^3 scf/d) [illegible]	4.7	5.1	4.4	4.3	4.3
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	—	—
14. Fuel oil in	NONE	NONE	NONE	NONE	NONE
15. Fuel P/steam P (psig)					
16. Burner #1		0/85	0/85	0/20	0/0
17. Burner #2	Don't Use	0/86	0/86	0/20	0/0
18. Burner #3		0/83	0/83	0/22	0/0
19. Burner #4		0/76	0/76	0/21	0/0
20. Burner #5		0/84	0/85	0/26	0/0
21. Burner #6		0/73	0/74	0/17	0/0

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description:	5-1	5-1	5-2	5-3	5-4
22. °2 air flow total P	–	–	–	–	–
23. P to Burner #1	11.0	15.1	12.1	11.7	11.9
24. P to Burner #2	38.0	17.0	13.5	13.1	13.1
25. P to Burner #3	11.1	14.5	12.9	11.5	11.7
26. P to Burner #4	10.2	16.5	16.8	16.8	17.0
27. P to Burner #5	10.7	14.8	12.0	11.7	11.7
28. P to Burner #6	11.1	14.6	11.8	11.6	11.6
29. Staging height (ft)	–	–	–	–	–
30. °2 air damper, % open	–	–	–	–	–
. °2 air T (°F) #1	–	–	–	–	–
32. °2 air T (°F) #2	–	–	–	–	–
33. °2 air T (°F) #3	–	–	–	–	–
34. Stack T (°F)	793	811	761	761	755
35. Fuel Oil T (°F)	198	198	198	198	198
36. Stack Damper* (% open)	89	98	80	80	78
37. Bottom Furnace P (iwg)	-0.34	-0.40	-0.27	-0.27	-0.27
38. Convective P (iwg)	+0.05	+0.01	+0.13	+0.11	+0.12
39. Stack P (iwg)	-0.02	-0.05	+0.07	+0.05	+0.03
40. Air Registers (% open)	100	100	100	100	100
41. Crude API Gravity	21.0	21.0	21.0	21.0	21.0
42. Flame Observations	Flames nearly transparent	Flames bluish yellow heights ~8-10ft	Flames lazier height can't be	Brn #2 yellow otherwise as in 5-2	
43. Other Observations	Fuel to Brn. #2 high Flame heights ~5 ft.	Stm. inj. thru oil T.B.	estimated (7-10 ft) →	→	

* Ind. at bot. of htr.

Page 3

UNIT OPERATING DATA **Test No.**_______

Test No.__________ **Date**__________ **Location**____________ **Engr.**__________

Unit No.__________ **Fuel**__________ **Capacity**____________________

Unit Type____________________ **Burner Type**____________________

1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr. P (psig)	49	49	49	49	49
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)					
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	811/753	809/795	790/769	790/785	786/780
18. Tube 15 Pass A/Pass B	780/740	778/780	759/761	761/776	751/771
19. Tube 20 Pass A/Pass B	790/767	803/816	786/790	787/802	786/796
20. Tube 25 Pass A/B (outlet)	821/805	845/857	823/832	833/850	840/849
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

st No.______ Date______ Location______ Engr. TIDONA

Unit No. 11 H 13 Fuel ADSORBER GAS Capacity 16250 bbl/d, 55 x10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DPA-22

Test Description: 2.3% O2 BASELINE LOW STM NAT. DRAFT STAGING/AIR REG. ADJUST.

1. Test Number	5-5	5-6	5-7	5-8	
2. Date	4-8-81	4-8-81	4-8-81	4-8-81	
3. Time	12:20	12:35	12:55	13:30	
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	7.4	7.4	7.4	7.4	
6. Crude T_{in} (°F)	343	343	343	331	
7. Crude T_{out} (°F) East	640	640	639	639	
8. Crude T_{out} (°F) West	637	637	633	632	
9. Crude P_{in} (psig) East	147	147	148	147	
10. Crude P_{in} (psig) West	139	139	140	139	
11. Crude P_{out} (psig)	33.0	33.0	33.0	33.0	
12. Reabsorber gas in x ~~305.856~~ 331.749 (10^3 scf/d) [illegible]	4.4	4.4	4.45	4.4	
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	—	
14. Fuel oil in	NONE	NONE	NONE	NONE	
15. Fuel P/steam P (psig)					
16. Burner #1	0/0	0/0	0/24	0/0	
17. Burner #2	0/0		0/21		
18. Burner #3	0/0		0/22		
19. Burner #4	0/0		0/22		
20. Burner #5	0/0		0/22		
21. Burner #6	0/0	↓	0/22	↓	

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.__________ Date__________ Location__________ Engr.__________

Unit No.__________ Fuel__________ Capacity__________

Unit Type__________ Burner Type__________

Test Description: 5-5 5-6 5-7 5-8

	5-5	5-6	5-7	5-8	
22. °2 air flow total P	—	–	–	–	
23. P to Burner #1	12.3	12.3	12.6	12.4	
24. P to Burner #2	13.6	13.6	14.0	13.9	
25. P to Burner #3	12.1	12.1	12.4	12.0	
26. P to Burner #4	17.0	17.0	17.2	17.3	
27. P to Burner #5	12.2	12.2	12.5	12.1	
28. P to Burner #6	12.0	12.0	12.2	12.0	
29. Staging height (ft)	—	–	–	–	
30. °2 air damper, % open	—	—	–	–	
°2 air T (°F) #1	—	—	–	–	
32. °2 air T (°F) #2	—	–	–	–	
33. °2 air T (°F) #3	—	–	–	–	
34. Stack T (°F)	776	776	780	778	
35. Fuel Oil T (°F)	198	198	198	198	
36. Stack Damper (% open)	89	89	89	99	
37. Bottom Furnace P (iwg)	-0.34	-0.34	-0.35	-0.52	
38. Convective P (iwg)	+0.07	+0.07	+0.06	-0.10	
39. Stack P (iwg)	-0.03	-003	-0.02	-0.05	
40. Air Registers (% open)	100	100	100	30	
41. Crude API Gravity	21.0	21.0	21.0	21.0	
42. Flame Observations	heights still hard to judge ~ 8-10ft		no sig. change in flames	flames very yellow heights >10ft	
43. Other Observations	flames more yellow				

Page 3

UNIT OPERATING DATA

Test No._______

Test No._______ **Date**_______ **Location**_______ **Engr.**_______

Unit No._______ **Fuel**_______ **Capacity**_______

Unit Type_______ **Burner Type**_______

	5-5	5-6	5-7	5-8	
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr P (psig)	50	50	50	50	
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)					
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	793/778	787/765	774/779	778/773	
18. Tube 15 Pass A/Pass B	764/768	756/753	764/768	756/757	
19. Tube 20 Pass A/Pass B	789/800	778/788	787/774	793/796	
20. Tube 25 Pass A/B (outlet)	833/840	820/827	823/834	841/852	
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

UNIT OPERATING DATA

Test No.______ Date 4-20-81 Location______ Engr. TIDONA

Unit No. 11H13 Fuel REF. GAS + NO 6 OIL Capacity 16250 bbl/d, 55 x10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description: BASELINE NEW BASELINE LOW STAGING MED. STAGING

1. Test Number	6-1	6-2	6-3	6-4	6-5
2. Date	4-20-81	4-20-81	4-21-81	4-21-81	4-21-81
3. Time	16:00	17:05	09:30	10:15	10:45
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.0	6.0	6.4	6.4	6.4
6. Crude T_{in} (°F)	405	405	406	406	406
7. Crude T_{out} (°F) East	649	647	649	653	648
8. Crude T_{out} (°F) West	633	635	636	642	647
9. Crude P_{in} (psig) East	130	129	140	138	140
10. Crude P_{in} (psig) West	123	121	137	132	135
11. Crude P_{out} (psig)	30.0	30.5	34.0	34.0	35.0
12. Reabsorber gas in x ~~[illegible]~~ [illegible] (10^3 scf/d) [illegible]	(1.9 w/ no oil) 1.6	1.6	(1.6 w/ no oil) 1.8	2.0	1.9
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	—	—
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	45/72	45/72	45/72	45/72	45/72
17. Burner #2	39/73	39/73	39/74	39/74	39/74
18. Burner #3	40/70	39/70	38/70	38/70	38/70
19. Burner #4	43/72	43/72	43/72	44/72	44/72
20. Burner #5	36/70	36/70	36/70	37/71	37/71
21. Burner #6	43/59	43/59	42/60	42/60	42/60

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description: 6-1 6-2 6-3 6-4 6-5

	6-1	6-2	6-3	6-4	6-5
22. °2 air flow ~~total~~ vel Δ P ("H₂O)	—	1.7	—	1.4	2.4
23. Fuel Gas P to Burner #1	2.7	2.7	3.5	3.7	3.5
24. P to Burner #2	0.05	→	→	→	→
25. P to Burner #3	4.1	4.1	5.2	5.3	5.2
26. P to Burner #4	5.7	5.4	3.7	4.1	4.0
27. P to Burner #5	2.9	2.9	3.2	3.3	3.3
28. P to Burner #6	3.1	3.1	3.6	3.9	3.8
29. Staging height (ft)	—	4	—	4	4
30. °2 air damper, % open	—	1/3	—	1/3	4/9
31. °2 air T (°F) #1 (Duct)	—	151	—	148	145
32. °2 air T (°F) #2 (Lance Air)	—	519	—	611	479
33. °2 air T (°F) #3 (Lance Skin)	—	1090	—	1110	~1000 ?
34. Stack T (°F)	700	693	719	729	717
35. Fuel Oil T (°F)	197	197	200	200	200
36. Stack Damper* (% open)	59	52	79	79	60
37. Bottom Furnace P (iwg)	-0.07 ?	-0.03 ?	-0.31	-0.26	-0.20
38. Convective P (iwg)	pos. off scale ?	pos. off scale ?	+0.06	+0.11	+0.18
39. Stack P (iwg)	pos. off scale ?	pos. off scale ?	+0.31 ?	+0.44 ?	> +0.5 ?
40. Air Registers (% open)	100	100	33	33	33
41. Crude API Gravity	21.8	21.8	22.6	22.6	22.6
42. Flame Observations	Brn #5 a little smoking; other	little change in fire appearance	Brn 5 still smoky otherwise no sig. change in flames	Same as 6-3 no sig. effect	flames bushier sl. ~8' hts
43. Other Observations	flames normal height ~8'		•Load change •Register change	on flames	1 rdg. intermittent

*Indication at bottom of htr.

Sight ports all open on bottom to observe air register openings directly

Page 3

UNIT OPERATING DATA

Test No._______

Test No._______ Date_______ Location_______ Engr._______

Unit No._______ Fuel_______ Capacity_______

Unit Type_______ Burner Type_______

	6-1	6-2	6-3	6-4	
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)	49	49	49	49	49
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)	44	44	44	44	44
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	729/755	740/747	750/755	756/755	759/751
18. Tube 15 Pass A/Pass B	705/745	715/743	721/732	725/737	729/736
19. Tube 20 Pass A/Pass B	728/761	733/751	741/761	751/768	756/762
20. Tube 25 Pass A/B (outlet)	759/780	764/776	774/789	781/799	791/796
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

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Data Sheet 6002-1

UNIT OPERATING DATA

Test No.________ Date 4-21-81 Location________ Engr. TIDONA

Unit No. 11 H 13 Fuel Res. GAS + No6 OIL Capacity ~~18,000~~ 16,250 bbl/d, 55 x 10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description:

	HIGH STAGING	MAX. STAGING	MAX. STAGING 45° OFF RADIAL	MAX STAGING TANGENTIAL	MAX. STAGING [illegible]	RETEST BASELINE
1. Test Number	6-6	6-7	6-8	6-9	6-10	6-11
2. Date	4-21-81	4-21-81	4-21-81	4-21-81	4-21-81	
3. Time	11:20	12:05	14.40	15:50	16:20	16:45
4. Load x 10^6 Btu/hr						
5. Process Rate x 1847.7 bbl/d	6.4	6.4	6.4	6.4	6.4	6.4
6. Crude T_{in} (°F)	406	406	408	408	408	408
7. Crude T_{out} (°F) East	648	645	651	654	648	648
8. Crude T_{out} (°F) West	647	646	643	638	644	644
9. Crude P_{in} (psig) East	139	144	144	142	142	142
10. Crude P_{in} (psig) West	133	140	140	139	139	139
11. Crude P_{out} (psig)	35.0	36.0	35.0	35.0	35.0	35.0
12. Reabsorber gas in x ~~[illegible]~~ 171.845 (10^3 scf/d)	1.9	1.8	1.9	1.8	1.8	1.8
13. Natural gas in x 169.044 (10^3 scf/d)	—	—	—	—	—	
14. Fuel oil in						
15. Fuel P/steam P (psig)						
16. Burner #1	45/73	45/73	44/73	46/73	46/73	46/73
17. Burner #2	39/74	39/74	39/74	39/74	39/74	39/74
18. Burner #3	38/71	38/70	39/70	38/70	38/70	38/70
19. Burner #4	44/72	43/72	44/72	44/72	44/72	44/72
20. Burner #5	37/71	36/71	42/71	42/71	42/71	42/71
21. Burner #6	42/60	42/59	42/60	42/60	42/60	42/[illegible]

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description: 6-6 6-7 6-8 6-9 6-10 6-11

	6-6	6-7	6-8	6-9	6-10	6-11
22. °2 air flow ~~total~~ Vel. ΔP (iwg)	4.3	4.8	4.8	4.9	4.9	0
23. Fuel Gas P to Burner #1	3.3	3.5	3.5	3.1	3.2	3.1
24. P to Burner #2	GAUGE O.O.S.	→	→	→	→	→
25. P to Burner #3	4.9	5.1	5.1	4.8	4.8	5.0
26. P to Burner #4	3.7	3.9	3.9	3.5	3.6	3.6
27. P to Burner #5	3.2	3.2	3.2	3.1	3.1	3.1
28. P to Burner #6	3.6	3.7	3.7	3.4	3.5	3.5
29. Staging height (ft)	4	4	4	4	4	4
30. °2 air damper, % open	2/3	100	100	100	100	—
1. °2 air T (°F) #1 COMB. AIR	140	145	148	150	144	—
32. °2 air T (°F) #2 LANCE AIR	386	371	407	426	457	—
33. °2 air T (°F) #3 LANCE SKIN	$\sim 1000^2$	$\sim 950^2$	1390	1370	1360	—
34. Stack T (°F)	674	674	698	703	703	725
35. Fuel Oil T (°F)	200	200	200	200	200	200
36. Stack Damper (% open)	60	69	50	50	50	79
37. Bottom Furnace P (iwg)	-0.19	-0.30	-0.29	-0.30	-0.28	-0.32
38. Convective P (iwg)	+0.19	+0.09	+0.09	+0.09	+0.09	+0.06
39. Stack P (iwg)	+0.66 ?	pos. ?	+0.62 ?	O.O.S.	O.O.S.	O.O.S.
40. Air Registers (% open)	25	10	10	10	10	33
41. Crude API Gravity	22.6	22.6	22.6	22.6	22.6	22.6
42. Flame Observations	more turbulence Tube metal temps.	flames very rough heights still ~8'	flames swirling hts appear unchgd	smoky firebox flames ~10'	smoky, long flames	as in 6-3 flames narrowed
43. Other Observations	rising significantly Stack Temp. down	All flames smoky no vis. smoke at stack			too high to guess height	~ shorter than 6-10; distinct

adj. reg to keep good draft

air reg. adj to get better draft

2 adj. intermittent

no smoke; Bricks clearing up flame height: ~8-10 ft

Page 3

UNIT OPERATING DATA

Test No.________

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

	6-6	6-7	6-8	6-9	6-10	6-11
1. Test Number						
2. Date						
3. Time						
4. Load						
5. Process Rate						
6. FUEL Oil Tank Level						
7. Oil Tank Level (bbls)						
8. Fuel Gas Hdr. P (psig)	49	49	49	49	49	49
9. Fuel Gas Brn Man. P (psig)						
10. Fuel Gas Control Valve % open						
11. Gas Control Valve ΔP (psi)						
12. Fuel Oil Control Valve % open						
13. Oil Valve Inlet P (psig)						
14. Oil Valve Outlet P (psig)	44	44	44	44	44	44
15. Oil Valve ΔP (psi)						
16. Tube Skin Temps. (°F)						
17. Tube 13 Pass A/Pass B	817/790	809/780	831/778	803/760	830/779	752/755
18. Tube 15 Pass A/Pass B	795/797	791/779	757/750	754/746	756/754	720/730
19. Tube 20 Pass A/Pass B	832/816	830/809	825/829	802/803	758/778	746/765
20. Tube 25 Pass A/B (outlet)	874/879	891/886	836/860	822/849	775/794	777/796
21.						
22.						
23.						
24.						
25.						
26.						
27.						
28.						
29.						
30.						

Data Sheet 6002-1

UNIT OPERATING DATA

st No.________ Date________ Location________ Engr. TIDONA

Unit No. 11H13 Fuel ADSORBER GAS + No 6 OIL Capacity 16,250 bl/d, 55×10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description:	BASELINE	LOW O_2	LOW STAGING LOW O_2	MED. STAGING LOW O_2	MAX STAGING LOW O_2
1. Test Number	7-1	7-2	7-3	7-4	7-5
2. Date	4-22-81	4-22-81	4-22-81	4-22-81	4-22-81
3. Time	08:05	10:30	11:25	12:15	13:55
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.4	6.4	6.4	6.0	6.0
6. Crude T_{in} (°F)	416	405	404	416	417
7. Crude T_{out} (°F) East	654	657	650	653	640
8. Crude T_{out} (°F) West	641	635	644	650	649
9. Crude P_{in} (psig) East	142	158	149	137	139
10. Crude P_{in} (psig) West	138	155	145	133	135
11. Crude P_{out} (psig)	35.0	36.0	35.0	32.0	33.0
12. Reabsorber gas in x 205.856 (10^3 scf/d) x .8348	(3.6 w/ oil) 1.8	1.8	1.8	(2.8 w/o oil) 1.5	1.4
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–	–	–
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	45/73	45/73	45/73	45/73	46/73
17. Burner #2	39/74	39/74	39/74	39/74	39/74
18. Burner #3	39/70	39/70	38/70	38/70	39/71
19. Burner #4	44/72	44/72	44/72	44/72	44/72
20. Burner #5	42/71	46/71	46/72	46/72	46/72
21. Burner #6	42/60	43/60	43/60	43/60	43/60

Page 2

UNIT OPERATING DATA - CONTINUED

Test No.________ Date__________ Location__________ Engr.__________

Unit No.________ Fuel__________ Capacity__________

Unit Type__________ Burner Type__________

Test Description: 7-1 7-2 7-3 7-4 7-5

	7-1	7-2	7-3	7-4	7-5
22. °2 air flow total P	—	—	1.3	2.9	4.5
23. P to Burner #1	3.1	3.1	3.2	2.1	0.0
24. P to Burner #2	0.05	→	→	→	→
25. P to Burner #3	4.7	4.8	4.8	3.4	3.3
26. P to Burner #4	3.5	3.6	3.6	2.6	2.5
27. P to Burner #5	3.0	3.1	3.1	2.5	2.5
28. P to Burner #6	3.4	3.4	3.4	2.6	2.5
29. Staging height (ft)	—	—	4	4	4
30. °2 air damper, % open	—	—	1/3	5/9	100
2 air T (°F) #1 COMB AIR	—	—	162	163	159
32. °2 air T (°F) #2 LANCE AIR	—	—	596	427	335
33. °2 air T (°F) #3 LANCE SKIN	—	—	1700	1700	1500 (?)
34. Stack T (°F)	732	696	698	652	630
35. Fuel Oil T (°F)	205	205	205	205	206
36. Stack Damper (% open)	79	61	69	59	58
37. Bottom Furnace P (iwg)	-0.33	-0.23	-0.16	-0.18	-0.11
38. Convective P (iwg)	+0.03	+0.11	+0.19	+0.17	+0.24
39. Stack P (iwg)	+0.11	+0.19	+0.28	+0.27	+0.33
40. Air Registers (% open)	33	33	33	10	10
41. Crude API Gravity	22.5	22.5	22.5	22.5	22.5
42. Flame Observations	Clear, #5 a little smoky, hts. range	flames longer, more ragged,	flames more transparent	flames darker w/ reg. adj.	V[illegible], dark, smoky firebox, Tops of
43. Other Observations	from 6'-8' except brn #2 which is ~4'	Smokier, hts 8'-10' xcpt #2 which is ~5'. [illegible] on Brn #5 No vis. emission from stack	lower (some > 10'), still more ragged about same width as w/o staging	flames all run together by ~4' ht Heights > 10'	flames indefinite flames themselves [illegible] Some bright yellow streaks coming from lances - jet type combustion

Page 3

UNIT OPERATING DATA

Test No.________

Test No.____________ Date____________ Location________________ Engr.__________

Unit No.____________ Fuel____________ Capacity______________________________

Unit Type______________________________ Burner Type__________________________

	7-1	7-2	7-3	7-4	7-5
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)	49.5	49	49.5	49.5	49
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve %open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve %open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)	44	44	44	44	44
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	751/752	761/773	758/775	757/761	790/801
18. Tube 15 Pass A/Pass B	721/726	725/702	729/O.O.S.	737/758	790/817
19. Tube 20 Pass A/Pass B	743/759	755/787	762/772	758/769	824/823
20. Tube 25 Pass A/B (outlet)	773/788	796/817	785/792	800/810	887/895
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

Data Sheet 6002-1

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UNIT OPERATING DATA

st No.________ Date________ Location________ Engr. TIDONA

Unit No. 11 H 13 Fuel RDS.GAS+ NO.6 OIL Capacity ~~10000~~ 16,250 bbl/d, 55 x 10^6 Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DPA-22

Test Description: REPEAT BASELINE

1. Test Number	7-6				
2. Date	4-22-81				
3. Time	16:25				
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.0				
6. Crude T_{in} (°F)	404				
7. Crude T_{out} (°F) East	660				
8. Crude T_{out} (°F) West	630				
9. Crude P_{in} (psig) East	170				
10. Crude P_{in} (psig) West	168				
11. Crude P_{out} (psig)	36.5				
12. Reabsorber gas in x 205.856 (10^3 scf/d) x .8348	(3.7 ~ 0.1 1.5				
13. Natural gas in x 169.044 (10^3 scf/d)	—				
14. Fuel oil in					
15. Fuel P/steam P (psig)					
16. Burner #1	46/73				
17. Burner #2	40/74				
18. Burner #3	38/71				
19. Burner #4	44/72				
20. Burner #5	38/71				
21. Burner #6	44/60				

Page :

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description: 7-6

22. °2 air flow total P	—				
23. P to Burner #1	2.6				
24. P to Burner #2	0.05.				
25. P to Burner #3	4.1				
26. P to Burner #4	3.2				
27. P to Burner #5	2.8				
28. P to Burner #6	3.0				
29. Staging height (ft)	—				
30. °2 air damper, % open	—				
. °2 air T (°F), #1	—				
32. °2 air T (°F) #2	—				
33. °2 air T (°F) #3	—				
34. Stack T (°F)	703				
35. Fuel Oil T (°F)	206				
36. Stack Damper (% open)	79				
37. Bottom Furnace P (iwg)	-0.30				
38. Convective P (iwg)	+0.06				
39. Stack P (iwg)	+0.12				
40. Air Registers (% open)	33				
41. Crude API Gravity	22.5				
42. Flame Observations	normal				
43. Other Observations					

Page 3

UNIT OPERATING DATA

Test No.________

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

	7-6				
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbl)					
8. Fuel Gas Hdr P (psig)	49				
9. Fuel Gas Brn Man. P (psig)					
10. Fuel Gas Control Valve, % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psig)					
14. Oil Valve Outlet P (psig)	44				
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	737 / 767				
18. Tube 15 Pass A/Pass B	702/ 744				
19. Tube 20 Pass A/Pass B	741/ 769				
20. Tube 25 Pass A/B (outlet)	773/ 800				
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

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Data Sheet 6002-1

UNIT OPERATING DATA

st No.______ Date______ Location______ Engr. TIDONA

Unit No. 11 H 13 Fuel Abs. Gas, +No. 6 oil Capacity 16250 bbl/d, 55 x10⁶ Btu/h

Unit Type CRUDE HEATER Burner Type JOHN ZINK DBA-22

Test Description: BASELINE LO-NOx PARTICULATE / REPEAT BASELINE

1. Test Number	8-1	8-1P	8-1		
2. Date	4-23-81	4-23-81	4-23-81	4-24-81	
3. Time	13:05	17:30	18:35		
4. Load x 10^6 Btu/hr					
5. Process Rate x 1847.7 bbl/d	6.0	6.0	6.0		
6. Crude T_{in} (°F)	416	416	416		
7. Crude T_{out} (°F) East	651	657	646		
8. Crude T_{out} (°F) West	642	636	642		
9. Crude P_{in} (psig) East	146	137	137		
10. Crude P_{in} (psig) West	135	134	133		
11. Crude P_{out} (psig)	32.5	32.5	32.5		
12. Reabsorber gas in x 205.856 (10^3 scf/d) x.8348	(2.8 w/o O.O) 1.8	1.4	1.5	2.8	
13. Natural gas in x 169.044 (10^3 scf/d)	–	–	–		
14. Fuel oil in				none	
15. Fuel P/steam P (psig)					
16. Burner #1	46/75	45/73	45/73		
17. Burner #2	39/75	39/74	39/74		
18. Burner #3	39/72	38/70	38/70		
19. Burner #4	43/72	41/72	44/72		
20. Burner #5	0/0	41/70	41/70		
21. Burner #6	43/59	44/60	44/60		

UNIT OPERATING DATA - CONTINUED

Test No.________ Date________ Location________ Engr.________

Unit No.________ Fuel________ Capacity________

Unit Type________ Burner Type________

Test Description: 8-1 8-1P 8-1

22. °2 air flow ~~total~~ Vel ΔP ("H_2O)	—	4.3	—		
23. P to Burner #1	3.5	2.1	2.5		
24. P to Burner #2	O.O.S.	O.O.S.	O.O.S.		
25. P to Burner #3	5.2	3.0	3.4		
26. P to Burner #4	4.0	1.6	1.8		
27. P to Burner #5	3.1	1.7	1.8		
28. P to Burner #6	3.7	2.3	2.5		
29. Staging height (ft)	—	4	—		
30. °2 air damper, % open	—	100	—		
. °2 air T (°F) #1 COMB AIR	—	168	—		
32. °2 air T (°F) #2 LANCE AIR	—	405	—		
33. °2 air T (°F) #3 LANCE SKIN	—	1350	—		
34. Stack T (°F)	716	685	709		
35. Fuel Oil T (°F)	203	203	203		
36. Stack Damper (% open)	78	68	79		
37. Bottom Furnace P (iwg)	O.O.S.	-0.14	-0.27		
38. Convective P (iwg)	"	+0.23	+0.10		
39. Stack P (iwg)	"	O.O.S.	O.O.S.		
40. Air Registers (% open)	33	10	33		
41. Crude API Gravity	22.5	22.5	22.6		
42. Flame Observations	normal,	flames have intense yellow cores ~3-4'	all brns firing oil		
43. Other Observations	Brn #5 not firing oil	tall and 1.5' wide. Tops indistinct, curving toward ctr of fire Lances facing toward heater centerline (vertical)	flame heights 6-8' [illegible] ~2' Use this BASELINE! Brn #5 better than before; still a little smoke there though		

UNIT OPERATING DATA **Test No.**_______

Test No._______ **Date**_______ **Location**_______ **Engr.**_______

Unit No._______ **Fuel**_______ **Capacity**_______

Unit Type_______ **Burner Type**_______

Page 3	8-1	8-18	8-1		
1. Test Number					
2. Date					
3. Time					
4. Load					
5. Process Rate					
6. FUEL Oil Tank Level					
7. Oil Tank Level (bbls)					
8. Fuel Gas Hdr P (psi)	49	49	49		
9. Fuel Gas Brn Man. P (psi)					
10. Fuel Gas Control Valve % open					
11. Gas Control Valve ΔP (psi)					
12. Fuel Oil Control Valve % open					
13. Oil Valve Inlet P (psia)					
14. Oil Valve Outlet P (psia)	44	44	44		
15. Oil Valve ΔP (psi)					
16. Tube Skin Temps. (°F)					
17. Tube 13 Pass A/Pass B	738/736	733/742	750/734		
18. Tube 15 Pass A/Pass B	716/711	714/726	726/715		
19. Tube 20 Pass A/Pass B	738/750	729/746	738/740		
20. Tube 25 Pass A/B (outlet)	770/783	750/771	758/767		
21.					
22.					
23.					
24.					
25.					
26.					
27.					
28.					
29.					
30.					

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Data Sheet 6002-1

FUEL ANALYSIS

(No. 6 Fuel Oil)

Location 7, Tests 1-1 through 8-1
No. 6 Fuel Analyses Results
(Sample typical for April - May 1981)

Constituent	Wt., %	Average
Carbon, %	87.15 87.40	87.28
Hydrogen, %	10.37 10.70	10.54
Nitrogen, %	0.88 0.88	0.88
Sulfur, %	0.88 0.91	0.90
Ash, %	0.013 0.012	0.012
Oxygen, % (by difference)		0.39
Heat of Combustion: Gross Btu/lb	18,300 18,350	18,320
Net Btu/lb	17,340 17,390	17,360

HP-67 KEYED CALCULATION SHEET* FILTER # X001

PARTICULATE EMISSION CALCULATIONS

Test No. 8-1P Date 4-23-81 Location Ref. Htr w/ SCA mod. Engr. TIRANA

Unit No. H H13 Fuel Oil Sampling Train and Method #5

Pitot Factor, Fs .83 Barometric Pressure, P_{bar} 29.55 (STO 0) in. Hg

Tot. Liquid Collected, V_{1c} 103.0 (STO 1) ml Total Particulate, M_n solids 90.1 Tot. 109.3 (STO 2) m gm

Velocity Head, ΔP 0.1 (STO 3) iwg Stack Temp., Ts 565 (STO 4) °F 565°30 Stack Area, As 13.91 (STO 5) ft^2

Sample Volume, Vm 30.01 (STO 6) ft^3 Stack Press., Psg -0.63 (STO 7) iwg Excess O_2, XO_2% 1.9 (STO 8) %

Orifice Press. Diff., H 0.64 (STO 9) iwg Stack Gas Sp. Gravity, Gs 0.97 (STO A) n.d.

Sample Time, θ 55 (STO B) min Nozzle Dia., Dn 0.375 (STO C) in. Meter Temp., T_m 73 (STO D) °F

Select F_e	Oil (A)	Gas (B)	Coal (C)	Other: 50/50 Oil/Gas
SC Feet/10^4 Btu	92.2	87.4	98.2	89.8 (D)

Press (E) if meter is not temperature compensated.

		Solid	Total	
1. Sample Gas Volume	$Vm_{std} = 0.0334\ Vm(P_{bar} + H/13.6)$		29.499	SCF
2. Water Vapor	$Vw_{std} = 0.0474\ V_{1c}$		4.882	SCF
3. Moisture Content	Bwo = Eq. 2/(Eq. 1 + Eq. 2)		0.1420	N.D.
4. Concentration	a. $C = 0.0154\ Mn/Vm_{std}$	0.0470	0.0571	grains/DSCF
	b. $C = 2.205 \times 10^{-6}\ Mn/Vm_{std}$	6.7356×10^{-6}	8.171×10^{-6}	lb/DSCF
	c. $C = \text{Eq. 4b} \times 16.018 \times 10^3$	0.1079	0.1309	grams/DSCM
5. Abs. Stack Press.	$Ps = P_{bar} \times 13.6 + Psg$		401.250	in. w abs.
6. Stack Gas Speed	$Vs = 174\ Fs \sqrt{\Delta PTs} \sqrt{\frac{407}{Ps} \times \frac{1.00}{Gs}}$		1495.2	ft/min
7. Stack Gas Flow Rate @ 70°F	a. $Qsw = \text{Eq. 6} \times As \times \frac{530}{Ts} \times \frac{Ps}{407}$		10,600.5	WSCF/min
	b. Qsd = Eq. 7a x (1. - Eq. 3)		9095.2	DSCF/min
8. Material Flow	Ms = Eq. 7b x Eq. 4b x 60	3.6757	4.4590	lb/hr
9. XO_2 factor	$XO_2f = 2090/(20.9 - XO_2\%)$		110.00	N.D.
10. Emission	a. E = Eq. 4b x Fe x Eq. 9	0.0665	0.0807	lb/MMBtu
	b. E = Eq. 4c x Fm x Eq. 9 x 1000	28.610	34.707	ng/joule
11. % Isokinetic	$I = \frac{14077 \times Ts(Vm_{std} + Vw_{std})}{\theta \times Vs \times Ps \times Dn^2}$		106.91	%

*If calculating by hand:
1) Convert T_s and T_m to °R
2) Multiply EQ 1 by $530/T_m$(°R) if meter not temperature compensated.
3) $F_m = 2.684 \times 10^{-5} \times F_e$

Data Sheet 6002-4
Revised 2/15/78

ENG: E. TIDD Jr

PARTICULATE CALCULATION SHEET

Test Crew Pioneer / EPS[illegible]

Test No. 8-1 P Date 4-23-81 Location

Box No. 212-3 Sample Probe Position

Test Description

FILTER X 001

Dry Gas Meter Vol. (ft^3)

Final 2421.70

Initial 2391.69

Total 30.01

Impinger Water Vol (ml)

	1	2	3	S. Gel	Total
Final	184	110	2	545.4	841.40
Initial	100	100	0	538.402	738.4
Δ Vol	84	10	2	7.0	103.0

Beaker No.	# 2	# 3	# 10	# 9	# 5	Filter No. X001	Blank No.
Date Weighed	5/14/81	5-14-81	5-14-81	5-14-81	5-14-81		
Tare Wt. 1	103.0969	100.1210	101.1924	106.9377	99.5327	.7980	
2	103.0967	100.1209	101.1923	106.9379	99.5328	.7979	
3	103.0966	100.1208	101.1922	106.9379	99.5328	.7981	
4							
5							
6							
Avg	103.0967	100.1209	101.1923	106.9378	99.5328	.7980	
Bottle No.							
Content	Impinger (Water)	Probe (Acetone)	Probe (Water)	~~Cyclone~~ Blank (Acetone)	H2O Blank ~~Flask~~ (Dry)		
Rinse (ml)	485	280	250	100	200		
Date Weighed or 250 Bake	5-18-81	5-18-81	5-18-81	5-18-81	5-18-81	X001	
Final Wt. 250 1	103.1174	100.1457	101.35	106.9493	99.5333	.8041	
2	103.1174	100.1458	101.2083	106.9494	99.5335	.8041	
3	103.1173	100.1455	101.2234	106.9491	99.5333	.8042	
4							
5							
6							
Avg	103.1174	100.1457	101.2522	106.9493	99.5334	.8041	
Residue wt Final 250-Tare	0.0207	0.0248	0.0599	0.0115 ? contaminated?	0.0006	0.0061	
Date Weighed or 650 Bake				(assume zero)			
Final Wt. 650 1							
2							
3							
4							
5							
6							
Avg							
Residue Wt Final 650-Tare							

Comments:

Data Sheet 6002-3

KVB

Test No. 8-1P

Engr. JIRONE
FROHOFF/PIONEER J.D.

STACK DATA

Date 6-23-81 Location TOSCO Unit No. 11 H13 Fuel OIL

Load ______ K#/hr or MBtu/hr ______ Filter No. X 001

Sample Box No. ______ Meter Box No. ______ Probe No. ______ Probe Length 6'5½

Stack Moisture 12 %

Ambient Temperature 100 °F

Nozzle Diameter 0.375 in.

Atmospheric Pressure 29.55 in.Hg

Stack Gas Pressure, Ps -0.63 iwg

Stack Area, As ______ ft^2

Remarks: TOTAL -30.01 (FT^3)

Final Meter: 2421.70

Initial Meter: 2391.69

STATIC ΔP -.63 55 min.

CP. .822

Time	Vm (CF)	Vacuum (in. Hg)	ΔP (iwg)	ΔH (iwg)	T_s (°F)	$T_{imp.in}$ (°F)	$T_{imp.out}$ (°F)	T_{filter} (°F)	T_m (°F) OUT IN
16:47		.2	.1	.64	600	80	50	245	100/100
1657		.2	.1	.64	580	140	55	250	80/75
17:07		.2	.1	.64	585	150	50	245	75/60
17.17		.2	.1	.63	545	150	45	240	65/60
1727		.2	.1	.63	540	150	45	230	65/60
1737		.2	.1	.64	540	155	45	240	75/65
1742		.2	.1						
TOTAL									
AVER.									

KVB DS 60-13
Rev. 5/79

A Research-Cottrell Company

KVB, INC.

RECORD OF VISIBLE EMISSIONS

Location No. EPA #6018
Test No. 8-1 PARTICULATE
Owner CRUDE PROCESS HEATER
Date 4-23-81
Boiler No. 11 H13
Observer J. PIONESSA
Weather Conditions CLEAR & SUNNY WITH GUSTY WINDS FROM (3 TO 15 MPH) BLOWING AT SOUTH TO SOUTHWEST DIRECTION
Observer's Location 500' FROM BASE OF STACK

TIME						COMMENTS	TIME						COMMENTS
HR	MIN	SECONDS					HR	MIN	SECONDS				
		00	15	30	45				00	15	30	45	
	00						15	30	0	0	0	0	
	01						15	31	0	0	0	0	
	02						15	32	0	0	0	0	
	03						15	33	0	0	0	0	
	04						15	34	0	0	0	0	
	05						15	35	↓	↓	↓	↓	
	06						15	36	↓	↓	↓	↓	
15	07	0	0	0	0		15	37	↓	↓	↓	↓	
15	08	0	0	0	0		15	38	↓	↓	↓	↓	
15	09	0	0	0	0		15	39	↓	↓	↓	↓	
15	10	↓	↓	↓	↓		15	40	↓	↓	↓	↓	
15	11	↓	↓	↓	↓		15	41	↓	↓	↓	↓	
15	12	↓	↓	↓	↓		15	42	↓	↓	↓	↓	
15	13	↓	↓	↓	↓		15	43	↓	↓	↓	↓	
15	14	↓	↓	↓	↓		15	44	↓	↓	↓	↓	
15	15	↓	↓	↓	↓		15	45	↓	↓	↓	↓	
15	16	↓	↓	↓	↓		15	46	↓	↓	↓	↓	
15	17	↓	↓	↓	↓		15	47	↓	↓	↓	↓	
15	18	↓	↓	↓	↓		15	48	↓	↓	↓	↓	
15	19	↓	↓	↓	↓		15	49	↓	↓	↓	↓	
15	20	↓	↓	↓	↓		15	50	↓	↓	↓	↓	
15	21	↓	↓	↓	↓		15	51	↓	↓	↓	↓	
15	22	↓	↓	↓	↓		15	52	↓	↓	↓	↓	
15	23	↓	↓	↓	↓		15	53	↓	↓	↓	↓	
15	24	↓	↓	↓	↓		15	54	↓	↓	↓	↓	
15	25	↓	↓	↓	↓		15	55	↓	↓	↓	↓	
15	26	↓	↓	↓	↓		15	56	↓	↓	↓	↓	
15	27	↓	↓	↓	↓		15	57	↓	↓	↓	↓	
15	28	↓	↓	↓	↓		15	58	↓	↓	↓	↓	
15	29						15	59					

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KVB, INC.

RECORD OF VISIBLE EMISSIONS

Location No. EPA # 6018

Owner CRUDE PROCESS HEATER

Boiler No. 11 H 13

Weather Conditions CLEAR & SUNNY WITH GUSTY WIND FROM (3 TO 15 MPH) BLOWING AT SOUTH TO SOUTHWEST DIRECTION

Test No. B-1 PARTICULATE

Date 4-23-81

Observer J. PIONESSA

Observer's Location 500' FROM BASE OF STACK

TIME						COMMENTS	TIME					COMMENTS
HR	MIN	SECONDS					HR	MIN	SECONDS			
		00	15	30	45				00	15	30	45	
16	00	0	0	0	0			30					
16	01	0	0	0	0			31					
16	02	0	0	0	0			32					
16	03	0	0	0	0			33					
16	04	0	0	0	0			34					
16	05	0	0	0	0			35					
16	06	0	0	0	0			36					
16	07	0	0	0	0			37					
	08							38					
	09							39					
	10							40					
	11							41					
	12							42					
	13							43					
	14							44					
	15							45					
	16							46					
	17							47					
	18							48					
	19							49					
	20							50					
	21							51					
	22							52					
	23							53					
	24							54					
	25							55					
	26							56					
	27							57					
	28							58					
	29							59					

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